THE REFINER AND NATURAL GASOLINE MANUFACTURER

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Description of Vapor Phase process for cracking. This article by Louis De Flores deals with a subject that has been somewhat neglected.

Operating costs system. Harry Pennington tells how to keep tab on what's happening by use of daily operating cost record

There are three principle methods of correcting feed water. Mr. Winslow this month explains the "Hot Process" for softening water.

Resume of Mid-Continent refineries, showing just what each plant was doing on August 15.

Vol. 2 No. 8 AUGUST, 1923 $1.00 Per Year

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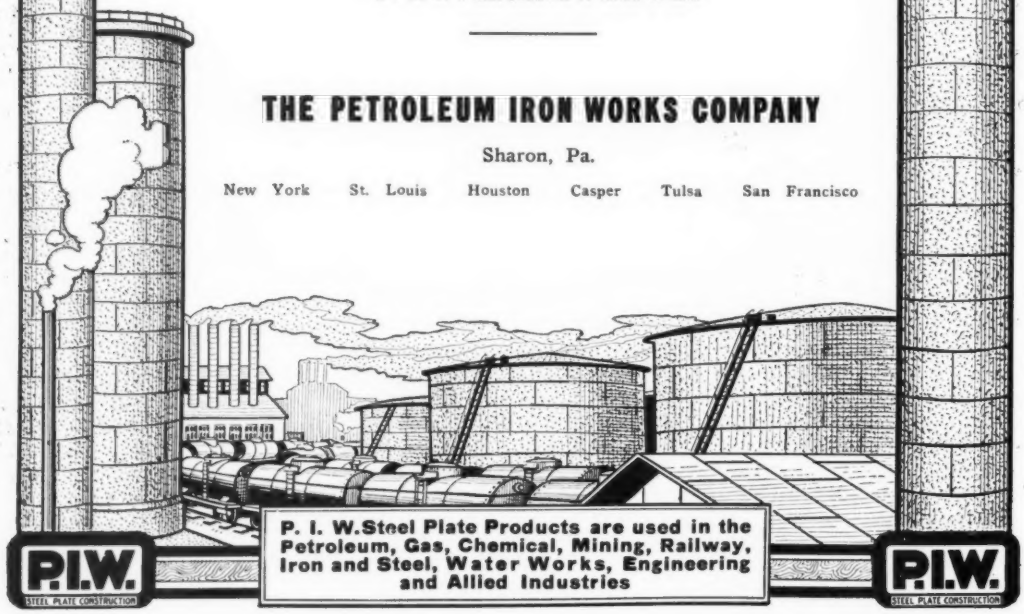

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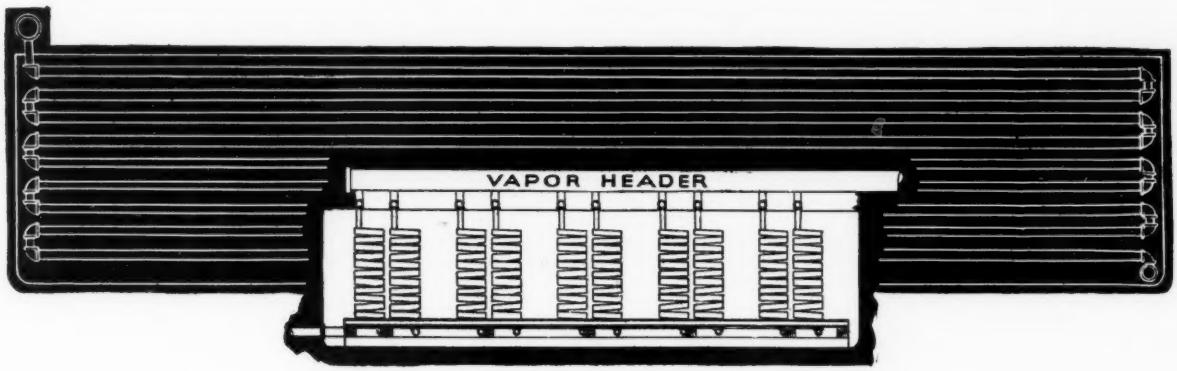

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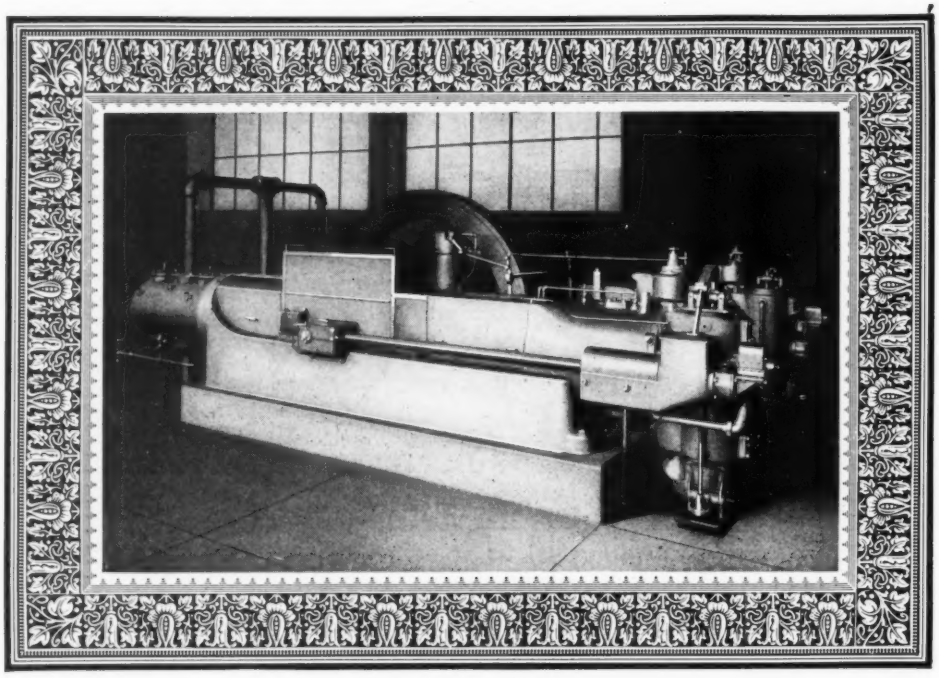

The Arab Gasoline Company of Eastland, Texas, is building a large gasoline plant at a time when the cost of construction is high and the wholesale price of gasoline is low, yet note how they are insuring the success of their venture.

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Staying Within the Law

A STATEMENT coming from L. V. Nicholas, president of the National Petroleum Marketers Association of Chicago, with reference to the shutting down of refineries, illustrates more forcibly than ever before the danger of a man of Nicholas' type heading any association of either manufacturers or distributing companies.

If medals were awarded for inconsistency, Mr. Nicholas would be decked from head to foot.

If unfairness could be reflected in fine raiment, Mr. Nicholas would be attired as Solomon in all his glory never was.

If short-sightedness were wealth, Mr. Nicholas would outclass the United States mint in point of money.

Unfortunately, no medals are issued for inconsistency. Unfairness more often leads to the receiver's court, and short-sightedness more frequently is reflected in not only bankruptcy of finances, but of friends as well.

In the statement referred to above Mr. Nicholas expresses hurt that the Western Petroleum Refiners Association did not grossly violate the Nation's anti-trust laws, and with the childish spite of a person of immature years, he broadcasts to the world that the refiners lost their nerve, and would not combine to close their plants, as he would have had them do.

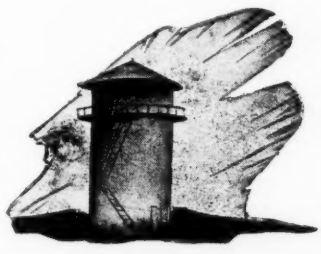
That the refiners may have considered closing their plants generally is probably true. That they decided against such a plan when it was realized that official action on their part would be taken as a conspiracy to violate the law, is a matter of record.

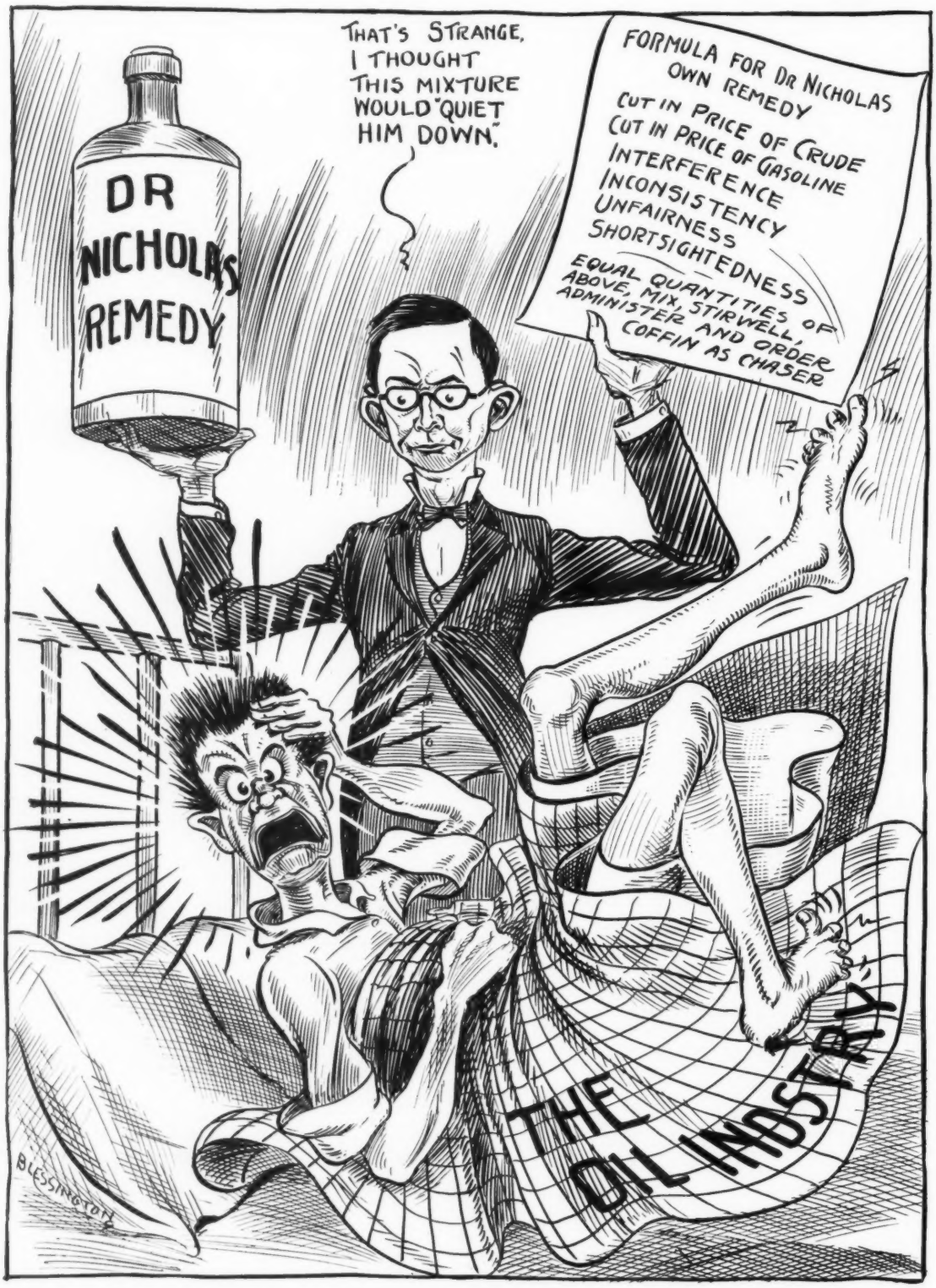
Mr. Nicholas has made much of Senator LaFollette's investigation to determine if the Standard groups were violating the law. One would think that Mr. Nicholas sympathized with any effort to bring individuals and companies to a rigid adherence to the laws of the land, and one would, logically enough, conclude that Mr. Nicholas stood solidly against any conspiracy to violate the anti-trust laws.

But the records in the case do not bear out the assumption that Mr. Nicholas was so sincere when it came to his own relation with anti-trust laws.

It is interesting to the public to know that Mr. Nicholas is in favor of gasoline price reduction right now, because that makes Mr. Nicholas a popular hero. He might even aspire to public office with some degree of success on such a platform—were it not for the fact that not longer than thirteen or fourteen months ago Mr. Nicholas urged members of his association to "get together" and boost the price of gasoline, which was in direct violation of the law.

Personally we believe that Mr. Nicholas is more dangerous to the industry at large in his present position as self-appointed czar of the oil business than LaFollette will ever be.

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Doctor Nicholas is much surprised that his special remedy hasn't accomplished the results hoped for. The cure is worse than the disease

Using Vapor Phase Process for Cracking

Charging stock is vaporized and then vapors are superheated to cause necessary cracking

By Luis De Flores, A. S. M. E.
Chief Engineer, New England Oil Refining Company, Boston, Mass.

AS WE look back over the history of the Petroleum Industry we realize that the practice of producing low boiling hydrocarbon oils from higher boiling fractions, by subjecting them to heat or so called "cracking," can hardly be called new. It is a fact, however, that only in recent years cracking has become known and used to any great extent, this having been caused by the tremendous development of the gasoline engine, which necessitated the producing of ever increasing quantities of gasoline.

The problem of producing sufficient gasoline for the growing demand is not solved by any means, and this fact is leading us to search for additional sources of cracking stock, as well as for an increase in crude production.

Up to the present our efforts have mainly been confined to the cracking of the heavier gas oil distillates, which are generally available at lower market prices. There are, however, circumstances arising from time to time, which make it possible to obtain kerosene distillates at such low figures that the possibility of using these for cracking cannot be overlooked. The object of this brief article is to point out this somewhat neglected field for cracking, for the handling of this class of stock.

Processes Now Used

The many processes now in use may be divided into one or the other of the following categories: viz, Liquid Phase and Vapor Phase.

In the Liquid Phase Process, the charging stock is treated, as the name implies, in the liquid state, this being effected by keeping it under high pressure to prevent vaporization. The second classification comprises processes which vaporize the charging stock first and then superheat the vapors to cause the necessary cracking.

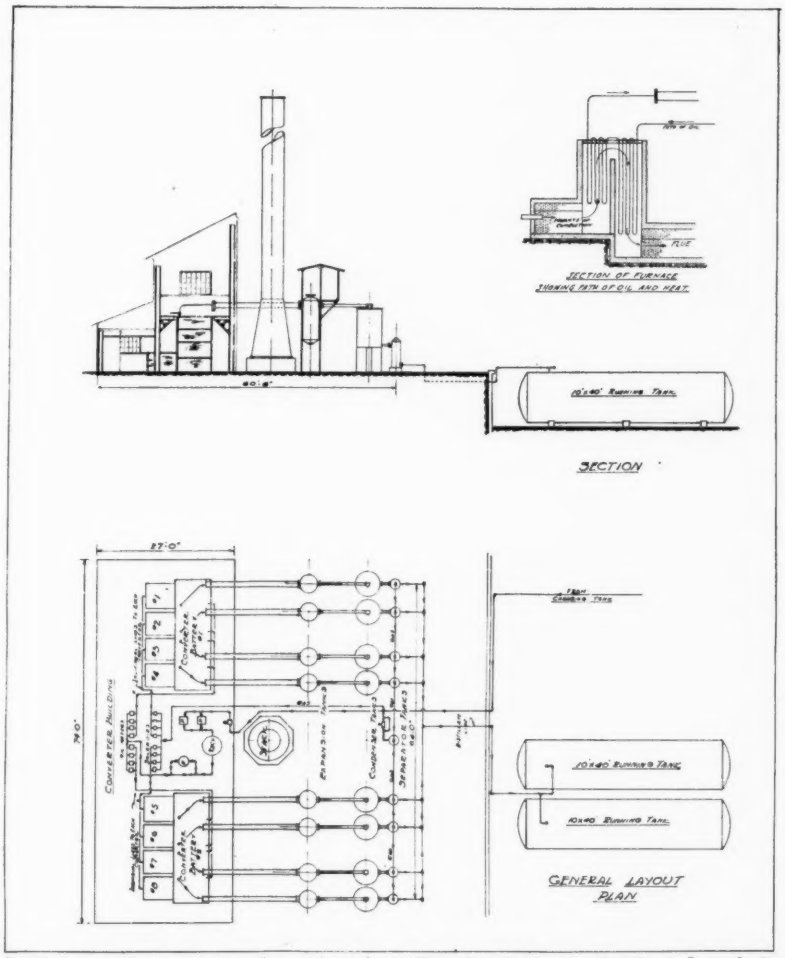
Practically all the Cracking Plants in commercial operation today are of the Liquid Phase type, this being due to the fact that it is best suited to handle the heavier gas oils, which constitute the greatest portion of the charging stock available. Few plants, if any, of this type, operate commercially on kerosene distillates, owing to the necessity of carrying exceedingly high pressures to obtain proper results.

Vapor Phase plants, however, can operate independently of pressure and can readily be adapted to run light charging stock, providing of course, that they are properly designed and operated. It is perhaps the lack of necessity for plants of this character which has retarded their development more than their existing shortcomings, which can be readily overcome, or at least compensated for, by natural advantages. The writer has found in the course of his experience that clean distillates above 36° Be. gravity can be treated without difficulty by the Vapor Phase apparatus, and that this apparatus can be constructed for the lowest unit cost. With regard to its operation, the carbon formation when properly handled, is negligible and the losses in noncondensable vapors when operating in connection with a refinery, are moderate. To illustrate these statements, a description will be given of a 1000 barrel Vapor Phase unit which has been in operation at the plant of the New England Oil Refining Company of Fall River, Massachusetts, for about a year, giving the average costs of operation and returns.

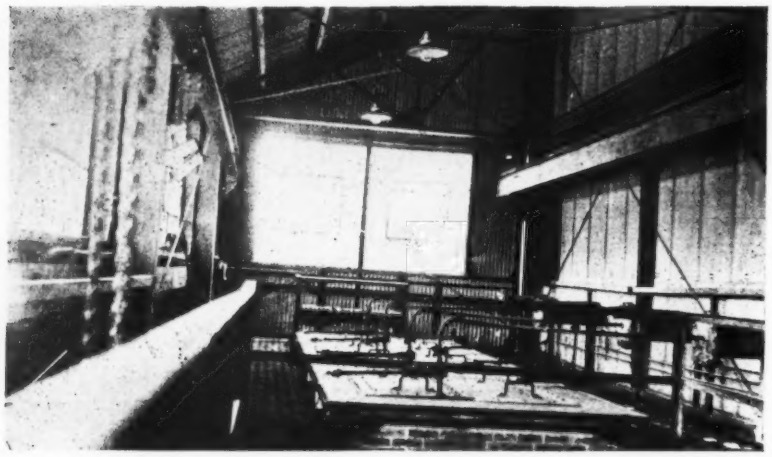
It may be stated that the theory underlying the conception of this plant, was to produce an apparatus which would treat a Mexican distillate of a gravity varying from 36° Be. to 42° Be., and at the same time obtain the largest daily output for the initial cost, rather than the maximum yield from a given quantity of oil. This was desirable owing to the ready market for the gas oil residuum as well as the lighter products. The operating margin was based on a charging stock price of between 4½c and 5½c per gallon, with a corresponding finished gasoline price of 14c and 20c per gallon, and residuum at charging stock values, since it passed gas oil specifications.

Design Simple

In the designing of the apparatus, every effort was made to obtain the simplest possible form, arranging the parts which would require cleaning so as to be readily removable. This permitted the operation of the plant with spares while the cleaning took place, thus reducing the idle time to a minimum. The necessity for cleaning was greatly reduced by the pumping of the oil through the tubes at a very high velocity, thus obtaining a very uniform



Showing general arrangement plan and section. The plan shows the directional flow of the charging oil from its tank, to feed pumps, through strainers, thence through receiving tank and filters to control meters and to furnaces. From the furnaces the distillate passes through vapor lines to expansion tanks, through condensers to separator tanks where gas and oil are separated. Oil passes thence to running tanks and the gas to the burners on the furnaces.



View showing Vapor line from top of converters. Note where hot joint of thermocouple is inserted. It is from here that the tubes are removed either by hand or by means of traveling crane shown above

heat transfer, due to the turbulent flow in the tubes, and preventing the particles of carbon from adhering to the walls. It may be interesting to note that the vapor velocities in the cracking zone run as high as 16,000 feet per minute.

It will be seen subsequently, that the operation is extremely simple. The oil is pumped through tubes, heated, the vapors condensed, liquid products recovered for re-distillation as crude, and the non-condensable product is burned as fuel. It is the very simplicity of the process which makes it possible to operate at low cost and permits its operation without infringing on existing patents.

Operation

As compared to results obtained in Liquid Phase Cracking, Vapor Phase work has disadvantages, but its advantages can be highly capitalized when treating light oils. In treating the oil in the Vapor Phase, considerably more uncondensable products are formed during the process. These products, however, are not a complete loss when operating a Cracking Plant in connection with a Refinery, since the gas can be used for fuel in the process and any excess may be burned under other stills or in the power plant. Consequently, the only real loss is the difference between the cost of the charging stock and the cost of an equivalent amount of fuel. This loss is often negligible owing to the small difference between the fuel oil and charging stock values. The great advantage of this type of apparatus is that it is inherently safe to operate due to the low pressures and the fact that only about a half a barrel of oil is in process at any time. Another advantage is that with moderate pressures, a lighter construction is permissible throughout, reducing the unit cost.

The plant for the New Enland Oil Refining Company was completed in May, 1922, and put into operation June 1, 1922. The materials for the plant were purchased a year and one-half before, during a period of high prices, bringing its total cost to about $75,000. The labor cost to erect this plant was in the neighborhood of $30,000, and assuming the purchase price of building equipment at the present market value, it could be readily constructed and put into working operation for $60,000.

The maximum capacity of the plant is a little over 1000 barrels of charging stock per day, and its normal operating capacity is about 850 barrels per day, or 85 per cent of the maximum. The average monthly capacity is about 25,000 barrels of distillate, the cost of operation in the neighborhood of 25 cents per barrel charged, (treating and refining costs about 15 cents additional), of which 65 per cent is labor and 35 per cent repairs, replacements, amortization, fuel, etc.

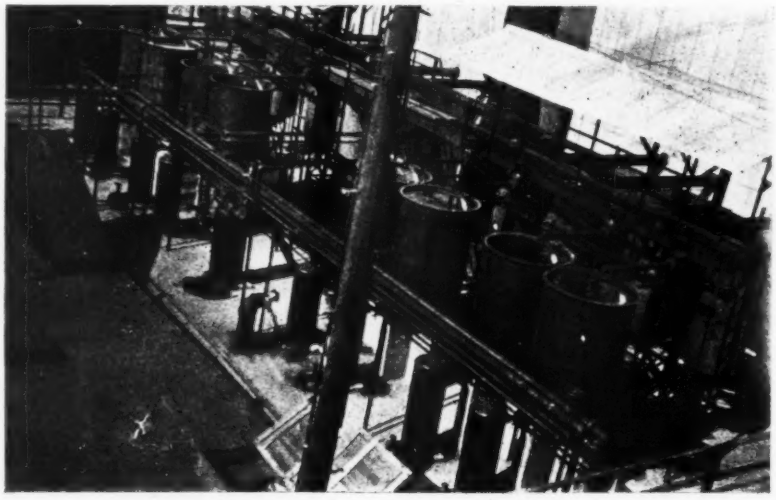
The construction costs of this plant should not be confused with the average statements made of the cost of a Cracking Unit. By "complete plant" is meant the plant in operating condition, including all equipment, such as Run-down tanks, Pumps, tieing in of condensing water lines, steam lines, electric lights, etc.; in other words, an actual operating unit connected with a refinery. The purchase of a Cracking Unit can sometimes be likened to the purchase of a radio set where one buys a so-called set and then finds it necessary to add accessories which are absolutely necessary for running, to the tune of about 100 per cent of the original cost; it is well to have clearly in mind what costs represent.

How It is Made

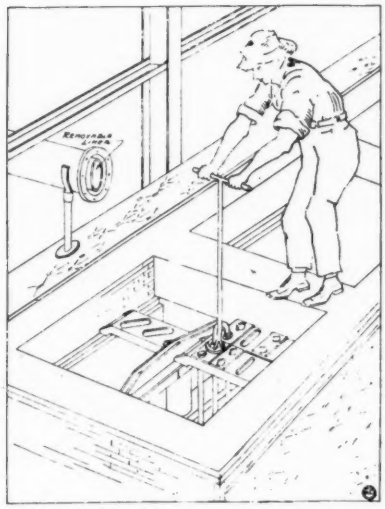
The Cracking Units consist of eight furnaces, as shown in the accompanying cut, (No. 1), each containing a single coil of 1½-inch tubing that is reduced to 1-inch in the cracking zone. The oil is passed through these tubes, which are placed vertically in the furnace, from the cooler to the hotter zone, and after being heated, vaporized and superheated, the product is let out through a large pipe into an expansion tank. The heat is generated in a combustion chamber of the Dutch oven type and follows up the front bridge wall of the hotter zone going over and down the rear of the same wall and out to the flue. This arrangement permits the tubes to be dropped in from the top through suitable castings, shown in cut No. 2, which hold them in place, and enables the joints to be kept outside the flames, at the same time making them readily accessible.

The eight units are built in two batteries of four each, to economize brick; they are so arranged that there is a space between the batteries, which can be utilized for the pumping machinery, controlling mechanism, etc. The tops of the units are flush with a working platform which permits the tubes to be handled readily when necessary.

The oil is pumped in at a pressure of about 200 pounds per square inch to insure proper flow, and after passing through a suitable air chamber and strainer, this pressure is reduced through individual needle valves, where the flow to each is regulated. It then passes through individual meters, which indicate the flow to each unit and thence on to the tubes in the rear pass of the furnace. The pressure at the intake of the tubes, which varies from 75 to 125 pounds, and the pump pressure, are indicated on a duplex gauge, so that when the plant is in operation, the pump pressure and the tube pressure are on the same dial, and their



View showing rear of plant with condensers and run down tanks.



Method of removing tubes, by means of socket wrench, which fits union collar. Tubes are held in place by lower half of union fitting into special punched plates, which rests on castings supporting same. The removable liner in Vapor pipe may be removed for cleaning by drawing same forward over furnaces

difference can be told by the angle of the two gauge hands. This enables the operator to readily determine what condition the tubes are in, for when they become carbonized, the resistance will increase and the difference between the pump pressure and the tube pressuure will be less, causing the two hands to approach each other, and reducing the angle between.

After passing through the tubes and becoming heated to a temperature of between 1000° and 1200° F., the oil passes through a large tube into an expansion chamber. This large tube contains a sleeve or liner which can be readily taken out for cleaning, by removing the flange on the end. A clean tube can then be substituted. This takes but a short time, and is necessary only after months of running.

After passing through the expansion chamber, the oil goes directly into a condenser and thence into a receiving tank where the liquid products and the gases are separated. The liquid products are drawn off at the bottom while the gases are taken off the top of the receiving tank, passed through an automatic valve regulating the pressure to the burners, the excess being passed out to the refinery to be burned under the boilers or stills.

The liquid products which may be called "Synthetic Crude" are then pumped to a storage from whence they are drawn for distillation in much the same manner as crude oil.

Controlled by One Man

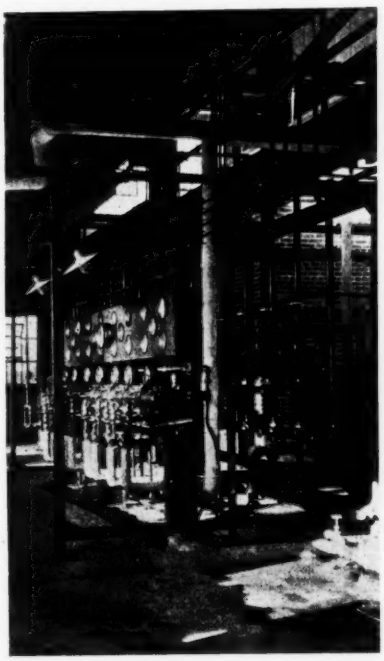
An important feature is the placing of the meters and all instruments on one board where they can be watched by one man who controls the whole operation.

The whole success of the operation in Vapor Phase, is the exact control and maintenance of the right conditions for cracking. Temperatures and pressures will fluctuate almost instantaneously when treating the oil in the gaseous state, since there is not the inertia of the liquid to fall back on as in the case of Liquid Phase operation; this necessitates recourse to special apparatus for regulation.

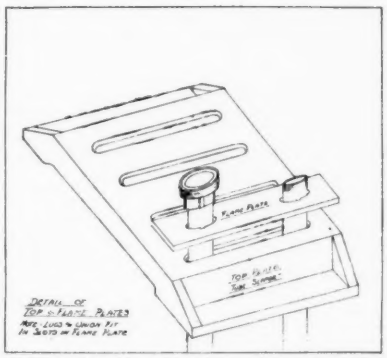
The firing is effected by gas burners controlled by Solenoid-operated valves, in turn controlled by a thermostat which may be described as follows: A pyrometer couple is placed at the outlet of the heating tubes, and electrically connected with a potentiometer system operating a galvanometer needle. The resistance in this system is calibrated to read the degrees of temperature, and by setting the resistance at a given point, the needle will only register zero at that point, which corresponds to the desired temperature. A chopping mechanism which is constantly in motion, causes certain elements in the mechanism to be moved, when the needle is off center, in proportion to the amount the needle is off. These parts of the mechanism make a contact which energizes the solenoids of the valves in such a manner that if the temperature is considerably off the desired point, the contact will be longer than if the needle is only a short distance off. The fuel is thus admitted by puffs of varying lengths according to the necessary correction. This control is really selective and is about the only way in which a furnace of this type can be operated without fluctuations or hunting. The temperature of the vapors can be maintained to within a variation of 10° F. without difficulty, day in and day out.

The apparatus itself is built by one of the leading instrument companies, utilizing their standard parts, modified to suit conditions; it is sturdy and reliable. As a matter of fact, there have been no shutdowns due to failure of the thermostats since the plant has been put in operation, and in former experiments, a similar apparatus was operated for nearly three years without any appreciable wear.

The heating coils are formed of a number of "U" bends of seamless cold drawn steel, which are connected by means of short return bends and pressed steel unions. They are supported in the furnace by slotted cast iron plates spanning the furnace shaft, the slots being just wide enough to let the tubes pass and hold the joint by means of a small plate fitted on the union.



View of interior of plant showing control board



Detail showing Top Plate, supporting flame plates, which are punched to fit union

It will be seen from the illustration that the tubes are removed by drawing them vertically, either by hand or by means of a small crane swung overhead. When cleaning is found necessary, the carbonized tubes are removed from the furnace to be turbined with an air drill, while the furnace is again put in operation with the clean sections. In this manner, the idle time of the furnace and the main part of the equipment is reduced to a minimum, accounting for the high normal capacity of the plant, which is about 85 per cent of the maximum.

The union joints are made up or broken by means of socket wrenches, handled from above, as shown in Cut No. 3, the movement of the union on the tube being prevented by the flame plate above mentioned, which acts as a wrench holding the female half of the union rigidly in position. The tubes and unions can be handled while the furnace is still hot, thus obviating the loss of time usually entailed in cooling the settings.

Little Fire Hazard

With regard to fire hazard in connection with this plant, it should be noted that only one-half a barrel of oil is in process at any time; should a tube burn out in the furnace, the products of combustion formed would be readily carried off in the flue and stack which have sufficient excess capacity. Steam connections are available at each meter and when such an event occurs, the oil is shut off of the particular furnace, the steam is turned on, scavenging the tubes in less than two minutes. The operation of the other units is not affected and about the only evidence of a fire is the presence of black smoke in the stack and a rise in temperature shown on the instruments.

The product made by this plant is yellow, unsaturated and difficult to refine. It does not, however, cost more than ½ cent a gallon to re-distill, treat and steam still, and therefore, such difficulties as may arise from the refining, are comparatively unimportant. As far as **refining is concerned,** it is admittedly an inferior product to the pressure distillates obtained from high

Gasoline Manufacturer Active in Louisiana; Many Plants Being Built or Contemplated

Monroe, La.—The natural gasoline manufacturing industry in Louisiana has experienced an unusual growth during the past four months, and at present a number of plants are being erected in both the gas and oil fields, while additional ones are contemplated. Except in the heavy gas areas, the gasoline concerns are adopting the smaller type of plants, and are erecting several plants in a district rather than to have one large central plant and pipe the raw material long distances. The Monroe gas field is now the scene of the greatest amount of building activity, due to the expansion of the carbon black industry in this area and state oil and gas conservation laws, which compel the carbon black operators to extract the gasoline contents of the gas before it is turned into the burners. The Haynesville oil field is being given three new plants by the Ohio Oil Company, and one is expected to be erected shortly by the Gilliland Oil Company.

The Monroe gas field, where a major portion of the country's carbon black is made, has two gasoline plants that will be completed in September, another that will start construction in a few weeks, and several others under consideration. The Consolidated Carbon Company, with headquarters at Shreveport, is erecting a high pressure F. E. Hosmer type of absorption gasoline manufacturing plant in conjunction with a new carbon black plant at Swartz in the Monroe gas field. This plant will have a daily capacity of approximately 50,000,000 cubic feet of gas when completed about middle of September, and will cost approximately $125,000. The gasoline recovery from the gas to be operated on will range from two-tenths to three-tenths of a gallon per thousand cubic feet.

The United Gas Products Company is also erecting an absorption gasoline plant at Swartz in connection with a carbon black plant, and both will probably be running before October 1. The natural gasoline plant will have sufficient capacity to charge 10,000,000 cubic feet of gas daily, and a recovery of about three-tenths of a gallon per thousand is expected. Materials are being purchased by the Central Carbon Company of Clarks, Louisiana, of which A. W. Johnson is president, for the erection of a natural gasoline manufacturing plant to be located near Clarks in the Monroe gas field. The absorption process is to be made use of, and when completed the plant will have a daily capacity of about 10,000,000 cubic feet of gas. The Standard Carbon Company of Monroe, Louisiana, is contemplating the erection of a 10,000,000 cubic foot natural gasoline and carbon black plant as soon as market conditions become more favorable, according to reports. Zeigen & Clark of Monroe are also planning on a new plant for the Monroe field, and will probably locate at Swartz.

Three Workmen Lose Lives In Dismantling Refinery

Wichita Falls, Texas. — Dismantling of the 3500 barrel refinery at Burkburnett after being purchased from the Manhattan Oil Refining Company by the Comet Oil Company for shipment to Los Angeles, California, has resulted in two serious accidents, costing the lives of three workmen. Late in July, J. H. Simpson, 23, was fatally injured after being struck on the head by a steel plate, while during the month before two men were killed and 10 painfully injured when a scaffold within a 55,000 barrel tank gave way while the tank was being torn down.

Wichita, Kans.—The plant of the Empire Gasoline Company in the Teeter pool in Greenwood County, Kansas, which was placed in operation in March with a capacity of 2500 gallons is to be increased to a capacity of 5000 gallons.

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pressure apparatus, but as a fuel in an internal combustion engine, it is more efficient and it will furthermore very materially decrease the propensity for knocking in straight run product, when mixed with it to the extent of from 5 to 10 per cent. It has been found most desirable to treat it with straight run naphtha and when present in quantities of the above order, there is little difference in the reaction.

During the operation, hourly samples are taken from each unit, these being inspected for color and gravity, which gives the measure of cracking. A composite sample from each unit is taken over a period of 24 hours for distillation, to obtain the gasoline content. A monthly cumulative sample of each 24 hour period is taken as a check on the whole operation, to determine the total percentages of gasoline produced during the month. The product of the plant is collected in separate tanks, carefully measured and tested before pumping to the refinery for distillation.

It should be noted that a cracked distillate made from Mexican crude, has, as a rule, too low a proportion of the intermediate range points to comply with Navy specifications. In order to call this gasoline Navy grade, it is therefore necessary to reduce the quantity by reducing the end point; in other words, chop off a portion of the higher boiling liquids. The yields given consequently appear somewhat low.

When using a Mid-Continent distillate to produce a motor gasoline of around 440 end point, the yields shown in the attached sheet of typical operation, would be over 30 per cent.

The plant is operated by ten men, three on a shift and one superintendent. The cleaning and replacing of the tubes is carried out by a single shift of two men. Two men on a shift would be ample for operation, reducing the labor cost to some extent, but in view of the desire to train additional men, three extra men were carried in the operation.

The training of men to operate this plant is comparatively simple, taking only a month or two for them to become familiar with their jobs, owing to the fact that most of the control is automatic and no difficulty is found in maintaining proper pressure and temperature conditions, once these have been determined by the Laboratory from the tests of samples.

The foregoing brief description of the New England Oil Refining Company's unit will illustrate the fact that Vapor Phase Cracking has possibilities, in view of the cheapness of construction, the equipment, and the ease and safety of operation. There seems little doubt that the use of this type of treatment of light oils would be profitable in many instances, though it should not be inferred that it will replace or eliminate Liquid Phase Cracking for the heavier ends.

Should Use Both Methods

It is the writer's belief that it would be found desirable to split the distillates to be cracked, into two sections, treating the lighter oils by the Vapor Phase and the heavier oils by the Liquid Phase. This method has the advantage that the two sections of distillates would have a close boiling range, making it possible to treat them at the temperatures at which they will crack best, thus thoroughly cracking the lighter fractions which often come through pressure stills practically untouched, and not over-treating the heavier portions which break down more readily. There is also the added advantage that a combination equipment of this character can be put in at a lower cost for a given capacity owing to the inexpensive construction of a Vapor Phase Plant.

The Refiner is in the habit of using various types of equipment for different operations, and it does not seem reasonable to expect to crack all types of distillates in the same manner or in the same apparatus. It is true that the charging stock for cracking plants is usually regarded as anything which the Refinery has available, which may minimize the importance of proper treatment. Thoughtful operators, however, have realized that the choice of cracking stock has great influence on the yields, and have found that the practice of selecting favorable distillates is distinctly profitable.

It is hoped that this article may call attention to the possibilities of cracking with Vapor Phase, for it is certain that if only a small portion of the energy which has been expended on perfecting Liquid Phase apparatus, is applied in the direction pointed out, very useful developments will ensue.

Another Unit to Be Added To Plant at Burkburnett

Wichita Falls, Texas.—The American-Invader Gasoline Company is adding another unit to its natural gasoline plant on the R. M. Waggoner lease in thee Northwest Burkburnett field which will bring the daily capacity of the plant up from 500,000 to one million cubic feet. The compression method is in use at this plant. The new addition will be ready for operation by September 1, and represents an expenditure of approximately $15,000.

Daily Operating Report a Profit Maker

Keeping check on what happened each day turned a North Texas plant from loser to money maker

By Harry Pennington

IN TAKING executive charge of a plant running Burkburnett crude at a loss, it was difficult to find a place to begin because of the many factors involved. An excellent system of accounting was in use, but since a trial balance was available only from two to three weeks after the close of an operating period, no practical operating value was had from these. The information came too late to correct an unprofitable operating condition.

Markets change; crude varies in quality from the same field; weather changes. Men will change employers, plant depreciates, component costs change, and to make the best of daily conditions, it became evident that to grasp the daily situation, a daily operating report was necessary. A copy of an average report under the new plan is printed herewith.

Daily Operating Report

This report was placed into use gradually; as operatives became familiar with each phase, and results desired, others were added until each day was made into a separate operating period, instead of monthly periods.

Each small item of improvement was in itself of no great consequence, but as item after item was taken in turn, analyzed and improved, the sum total of net cash improvement in earnings began to mount, and within 30 days, the plant was running at the rate of a net cash profit of better than one million dollars annually instead of a loss at the rate of nine hundred thousand dollars yearly.

The old adage of "little drops of water, little grains of sand," surely applies to refining.

Most large plants have all the information, probably some of them have more than shown in these operations. The expense of a competent staff of mechanical or combustion engineers, analytical chemists, and the like, has long been known to be trifling as compared with results obtained, both as to operating economies and the quality of products.

This operating report is not in the nature of an accountant's statement; it enters into no accounts but does furnish to the executive in charge immediate information of operating results. It serves two purposes, both of equal value; one being an exposition of operating conditions for the technician's use in analytical study, the other being the establishment of close contact between operative and executive. Good men will use more intelligent thought and care when they know their efforts are observed and appreciated.

This Report Simple

This plant was of such size that all operations could be condensed on a single sheet.

The plant had five 10 by 40 foot fire stills running continuously, one 12 by 40 foot steam still with fire under it, an 8 by 30 foot heat exchanger, four 100 h.p. horizontal return tubular boilers, no superheat, with all pumps and auxiliaries steam driven.

Each still was equipped with a 5x20 foot shell vapor tower, filled with crocks, each tower back trapping one stream to its still, remaining vapors going overhead to condensers.

What It Shows

Taking the report in detail, the first item is atmospheric temperature, barometer and relative humidity. These factors affect cooling water temperatures, which in turn are of prime importance in condensing primary vapors from light crude.

On a warm day with low relative humidity, cooling water may be cooler than on a cooler day with high relative humidity, and troubles with cooling water may be located from these data.

The rate of charging crude bears directly upon recovery, since the most economical charging rate—that is the rate productive of the highest recovery—will be indicated by that rate securing the highest percentages. And, when capacity is desired, close attention to the various components usually disclose some removable constriction that allows a further increase in charging rate while maintaining recovery percentages.

There are periods of flush production, also, that although the maximum percentages may not be maintained when running at, say 125 per cent capacity, still the additional crude charged may more than offset the loss in recovery, resulting in a greater net gain. This information is of value, especially when the sales department may be considering a contract covering certain products.

Heat Exchanger

Heat exchanger temperatures disclose the characteristics of this auxiliary. The record shows that crude leaving the exchanger had temperature 270° F. less than residue entering and that residue leaving had 164° F. more temperature than crude entering. This at once suggests a better design—counter current preferably. This exchanger had the usual pipe coils arranged in series, and while ample surface was present, a counter-current

OPERATING REPORT
Burkburnett Refinery

Date 9/25/20 No. 84 Temp. Atmosphere Min. 64 Max. 88 Barometer 29.4
Weather CLOUDY Relative Humidity 62

Barrels crude per hour 190.7
Gravity, Be. 37.9 I.B.P. 102
Temp. crude entering exchanger 76° F
Temp. crude leaving exchanger 275 F
Temp. residue entering 545 F
Temp. residue leaving 240 F

FIRE STILLS: STREAMS:

	Temp.	Gravity		Initial	End.
No. 1	275 F.	66.7	Be.	108 F.	320 F.
No. 2	380 F.	55.0	Be.	245 F.	380 F.
No. 3	440 F.	47.6	Be.	270 F.	470 F.
No. 4	500 F.	42.5	Be.	330 F.	F.
No. 5	545 F.	38.5	Be.	F.	F.

Gas oil back trap 5th, tower:
Temp. stream 168 F. - Gravity 34.1

Steam Still: OFF
Temp. 6 Gravity I.B.P. E. P.
Pressure steam into stm. still
Temp. steam into stm. still

SMOKE FLUES ALL STILLS:

	Temp.	CO 2%
No. 1	560	11.4
No. 2	610	10.6
No. 3	640	9.9
No. 4	680	9.8
No. 5	710	9.9

BOILERS:
Steam pressure 85
Smoke flues:

Temp.	CO 2%
No. 1	560 9.8
No. 2	580 10.0
No. 3	OFF —
No. 4	650 10.2

BOILED FEED WATER:
Temp. to feed pumps 98° F
Pounds per hour as pumped 10320
Percentage of load on boilers 95.6

CONDENSERS:
Temp. No. 1 138 F
No. 2 140 F
No. 3 142 F
No. 4 145 F
No. 5 146 F
Gas oil coil 98 F
Steam still —

Condensing Water:
Temp. in pond 108 F
Temp. make up water 76 F
Bbbls. hour from pond 140
Bbls. hour make up 130

RECOVERIES:

Percentages:	Gals.	$	$
Gas 38.9	74797	21½	1608.35
Kero 11.2	22496	12	2699.52
Gas oil 5.5%	10575	8	846.03
Fuel oil 42.0%	80757	7	5652.99
Loss 1.9%			
Total 100.0%			25,279.89

COSTS:

Crude 4578.1 bbls. @		18312.40
Pay roll, bbl.	.091	416.60
Chemicals	.012	54.93
Fuel oil	.078	357.08
Repairs	.040	183.12
Depreciation	.040	183.12
Tank cars	.170	778.26
Supplies	.009	41.20
Ins. tax. misc.	.048	219.75
Total	.488	2234.55

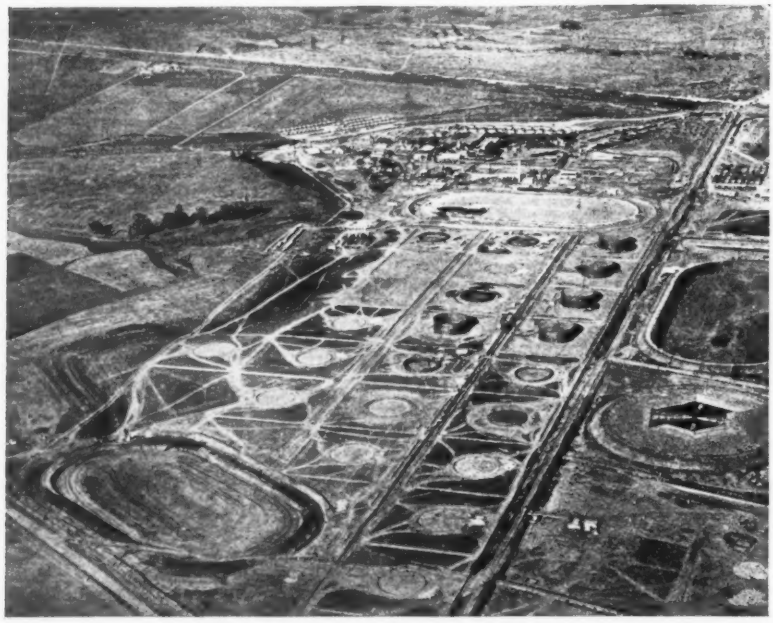
PRODUCTS:

	Gas.	Kero.	gas oil	fuel
Gr.	58.2	42.1	34.1	23.1
I.B.P.	118F	330F	455F	
E. P.	436F		710F	
Flash		150F	180F	107F.
Fire		157F		
Color	26		5	

NET CASH POSITION:
GAIN $ 4732.94

Equivalent from and at 212 F.
PERCENTAGE OF EFFICIENTY 67.8

Size pond water pump 10x6x12-60 B. P. M.
Size make up pump 12x7x12-40 B. P. M.



Pan American Petroleum Corporation's large tank farm and refinery at Watson, near Los Angeles, picture being taken from the air late in July. Pan American farm lies to left of road, while a portion of the Shell Company tank farm is shown to the right of the road. Large reservoir at top to left has capacity of 1,250,000 barrels and is practically completed. Reservoir at bottom will have capacity of 1,500,000 barrels. Erection of eleven 80,000 barrel steel tanks has been started and the program calls for 31 steel 80's. The reservoirs are cement lined and will be covered.

arrangement, just as easily built, would impart some of the heat lost in residue leaving to crude so as to narrow the temperature differences, reducing fuel and leaving less work for No. 1 still to do, or affording a greater flexibility of temperature ranges of the entire battery, so that the cuts can be made as may be best.

It also suggests that a stream might be taken from the exchanger.

Streams

The characteristics of each stream are given. No. 4, the control still in light oil distillation, produced kerosene with initial of 330° F. That fraction distilling between 330° F. and 437° or 450° F. properly belongs to a naphtha cut. Although towers were large, closer fractionation was not possible except by extensive changes in tower construction, so the fourth stream was re-run batch, reducing, making naphtha, kerosene and a small percentage of bottoms.

For the same reason No. 3 stream was made a re-run stream.

Some crudes afford a higher percentage by re-running. This may be due to a slight cracking effect, since, from this crude, all re-run fractions had a lower initial and gravity.

Re-running, aside from this however, had the effect of fractionating towers. Both methods, by cutting into the crude deeper and re-running, will cut closer, so that the combination of both tower and re-run in this plant afforded a higher recovery when running this crude.

The plant had ample steam still capacity.

Fuel

The next items cover combustion of fuel oil in still and boiler furnaces. The flue gas of each furnace was analyzed in an Orsat apparatus. A CO_2 recorder may be used but should be frequently checked with the Orsat apparatus.

The percentages of CO_2 and CO and O furnish the index of combustion, and of the condition of furnaces, including air leakage through the brick setting.

Furnace design has all to do with fuel economy. The essential requirements of complete combustion of fuel oil are: perfect atomization, correct air supply, complete combustion before the burning particles of fuel contact with the relatively cold still surface, even temperature in all parts of the furnace or no cold spots, correct exposure of heated brick, correct air supply.

The installation of Ellison differential draft gauges for air supply control was essential. This gauge operates on the differential plan. An ordinary U tube indicates draft in inches of water pressure. If dampers are closed, maximum draft is indicated in the stack. The Ellison gauge is an indicator of the quantity of air passing through; is an excellent instrument, and when carefully used, the best operating fuel economy can be duplicated continuously.

Stack temperatures afford a measure of firing characteristics as well as faulty furnace design. Stack temperatures, manifestly should be low.

These furnaces were well constructed, but the percentages of CO_2 were between 4 and 6 per cent, indicating a large excess of fuel comsumption over actual requirements due to faulty design, faulty firing and faulty draft control.

The average still setting in battery has all smoke flues to one stack. These smoke passages are not of the same length for each still, and it is therefore evident that one damper in the stack will not control the draft of furnaces individually. Especially is this true of still furnaces where hotter fires are carried under some stills than others. Crude oil from different parts of the same field necessitates change of temperatures for end point control, storage crude as compared with fresh crude also makes much difference, and where still temperatures must be changed, firing must change requiring individual draft control.

Still furnace smoke flues are usually designed too small; a larger flue, with a damper affords more flexibility of draft control.

Ample draft allows realization of maximum still charging capacity, and where capacity is not realized, much of the difficulty may be traced to furnace and draft.

Boilers, on the other hand, are fired as evenly as possible so as to distribute load equally, but here, also, breeching design, places unequal draft upon individual furnaces so that individual draft control is necessary also.

After analyzing these conditions and installing dampers for draft control, the percentage of CO_2 began climbing.

Since CO_2 is a direct index of combustion, complete combustion being when one atom of carbon unites with two atoms of oxygen, it follows that the highest percentage of CO_2 is desirable. CO, O, and N were also measured but are not included in this report.

The percentage of CO_2 was advanced to the figures shown in the report, resulting in a material reduction in fuel expense. These investigations also resulted in a material increase in capacity, while maintaining recovery percentages.

While patent furnaces will better certain conditions, still these should be installed only with a complete realization of capacity as well as economy.

Targets and baffles were removed to prevent overheating and coke spots, as well as to better conditions.

Boiler Feed Water

Notes on boiler feed water indicate the amount of steam used, affording a tab on reductions. Following steam from the boiler, many wastes of steam were corrected, such as excess steam above requirements in still, poor insulation causing condensation, leaky and improper set slide valves of pumps. When steam consumption was reduced, three boilers at normal load furnished ample steam so that one boiler was cut out and used for reserve.

Boiler feed water showed temperature of 98° F. Water from No. 5 condenser box raised this somewhat, although a water softener would have raised this temperature more, as well as removing hard scale forming solids.

Condensers

The temperature of water in condenser boxes is in the centre—an average. Pond water, from which circulating water pumps drew, was 108° F. Entering the bottom of No. 1 condenser box, it was evident that this temperature was not sufficiently low to condense the lighter fractions of a crude oil boiling at 102° F. No. 1 lookbox showed some pressure from uncondensed vapors which were piped to run down tanks.

Spray nozzles, operating with the spray head from boxes to pond, corrected this condition, so that recovery of lighter fractions was improved ma-

terially, reducing the refining loss, as well as making a better product.

All equipment was maintained at its best; every condition that prevented full realization of schedule was carefully investigated and remedied. Faulty operation afforded the main difficulty and in all such cases, the operator was carefully instructed. A repetition called for something else not so pleasant to such operator. Definite placing of responsibility has much to do with the successwul working of any business, both as to creating initiative and continuing good work.

Other Items

In examining the gauges and gravity of oil in the various refinery tanks, the gauge reports showed an average loss of one-half degree in transfers of crude and light oils. Tank connections were immediately changed, eliminating 75 per cent of this loss.

Car loadings of gasoline also showed a loss of gravity as well as quantity. Cars were then loaded from bottom.

Fuel cars showed outage from shrinkage of oil loaded hot, calling for freight payment on outage. Cooling oil before loading eliminated all outage claims.

Treating was studied for methods of improvement. Loss from agitation was reduced.

No distillates are shown in recovery percentages. All re-run stock was separated as if re-run and quantities so obtained used in ascertaining the percentages of finished products.

The elimination of teams carried on pay roll regularly and hiring them only when needed afforded a reduction.

While these items, it would seem, would not appear on a pay roll unless the expense were justified, still they will appear because some one in the organization dislikes to take them off and so tell the bird who is perched on the pay roll.

Car movements for handling increased runs were speeded up by pushing through terminals and divisions. The traffic department placed a man at each important division or terminal for the purpose, increasing car mileage earnings.

Straight train load shipments were made. At times straight trains went to destination; at others, the trains were made up to handle as far as possible as such, then split, each car then going to its destination. Prompt unloading was insisted upon and the telegraph was used freely for this purpose.

The sales manager furnished the daily sale value, and since the cost of crude was known, a daily cash position was indicated.

Other items of overhead, depreciation averages, insurance of all kinds, taxes, supplies, repairs, chemicals, tank cars, were furnished by the accounting department from the preceeding trial balance, and in terms of cents per barrel, are shown, so that the net daily cash position is indicated.

This report was made under supervision of the refinery superintendent, assisted by the chemist and engineer. Both engineer and chemist had an exceptionally analytical turn of mind, being employed because of these qualities, and were careful and painstaking in their wish to secure the best records.

Taking an earlier operating report and comparing with this, these differences became evident.

The cash position showed, after a few weeks, important gains. These gains came from what may be separated into two phases: one being the direct reduction of all charges per barrel of crude charged due to arranging the plant components so as to increase runs; the other, about an equal amount, due to a total increase in earnings from increase of 3.6 per cent in gasoline recovery; recovering a naphtha cut from the fourth stream; reduction of fuel; reduction in refining and crude evaporation loss; improvement in product; reducing car loading evaporation loss; increasing car mileage.

All these items when added, showed in succeeding profit and loss statements, that conclusions arrived at in these daily reports were within four to six per cent of being correct as to net results.

Due to an error in the last issue of The Refiner and Natural Gasoline Manufacturer, the authorship of the article appearing on page 5, entitled "Refining Distillates vs. Light Oils," was omitted.

This interesting discussion was written by Drs. Gustav Egloff and Jacque C. Morrell and was used in The Refiner through the courtesy of the Research Laboratories of the Universal Oil Products Company.—Editor.

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Correcting Feed Water Is Important Item

Problems found in softening water and a description of the hot lime-soda process

By Joseph C. Winslow

There are three principle methods of correcting feed water to prevent scaling, and no doubt each system will find its advocates and its opponents.

The accompanying article deals briefly with the problems of water softening, and describes in detail a hot lime-soda process developed with excellent success by the company with whom the author is associated.

Mr. Winslow is with the Graver Corporation and his article will be of interest because of the extensive experiments made by the Graver Corporation in water softening.—Editor.

OBTAINING a good water for boiler use and for cooling gas engines is one of the big problems of all power plant engineers for refineries, especially through the southwest and west.

Practically no water is pure except rain water and even that is corrosive at times. Ground water from wells or surface water from lakes, ponds, rivers contain dissolved substances and foreign material in suspension.

The foremost trouble experienced in boilers from incorrect water is that of scale formation. This is caused by the carbonates and sulphates of calcium and magnesium depositing on the tubes and plates of the boiler in a hard impervious mass. This formation is caused by the heat and concentration of the

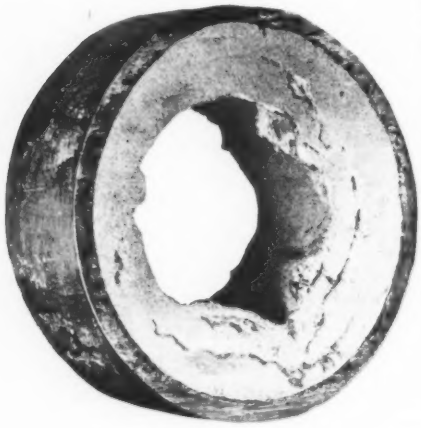


Fig. 1

water throwing these dissolved substances out of solution.

This deposit on the tubes is an excellent heat insulator and so increases the amount of fuel necessary and at the same time decreases the efficiency of the boiler. Experiments show that one sixteenth of an inch of scale increases the fuel consumption from 10 to 15 per cent. There is also the great danger of overheating, which weakens the tube, eventually causing it to burst. The scale can be removed, but this necessitates taking the boiler out of service, the cost of labor in removing it and the extra investment for stand-by equipment necessary to reach peak loads. The devices for removing the scale generally operate by knocking or chiseling. This has the effect of gradually loosening the tubes and plates.

Corrosion

Another cause of expense with incorrect feedwater is the corrosion of tubes and plates generally due to acid in the feed water or to electrolysis. The tube illustrated shows what will happen when water containing corrosive materials is used.

Foaming and priming of boilers is caused by the water in the boiler containing an excessive amount of solid matter, which generally is suspended matter carried into the boiler in the water or the dissolved salts of sodium. This trouble is augmented by the continual evaporation of the boiler contents. This causes the water to foam and carry over into the steam lines solid matter which tends to clog the pipes and water which makes "wet" steam. To relieve this it is necessary to blow off most of the water in the boiler. "Blow-downs" too are a waste of fuel and time as there is a drop in steam capacity until the added water is raised to steaming temperature.

Fig. 2

Cooling Chamber Clogs

With gas engines the main trouble is that the cooling chamber becomes clogged due to the deposit of scale from hard, calcium and magnesium, bearing water. This scale formation prevents the heat from reaching the circulating water and so prevents any cooling action. Frequent changing of piston heads results.

There are three main ways to correct feed water: "compounds," evaporators and water softeners. This article discusses the water softener system.

A water softener is an apparatus for removing the scale forming and corrosive salts from the water before it enters the boiler. There are two types of softeners—the exchange or zeolite type and the lime-soda type.

"Zero" Water

The zeolite type of softener produces water of "zero" hardness. This is done by passing the water through a layer of mineral called zeolite, which removes practically all of the calcium and magnesium substituting sodium in their place. That is, it changes the incrusting or scale forming contents of water to non-incrusting, non-scale forming.

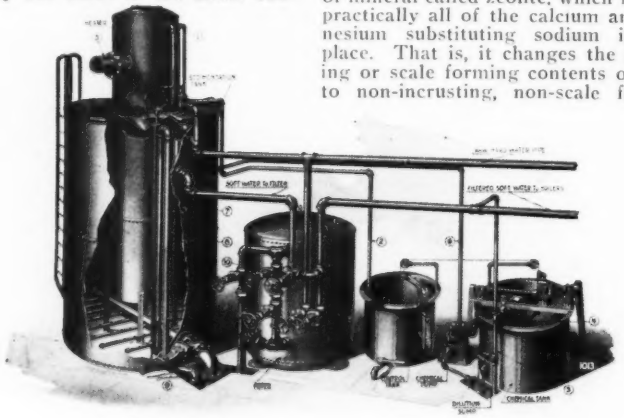
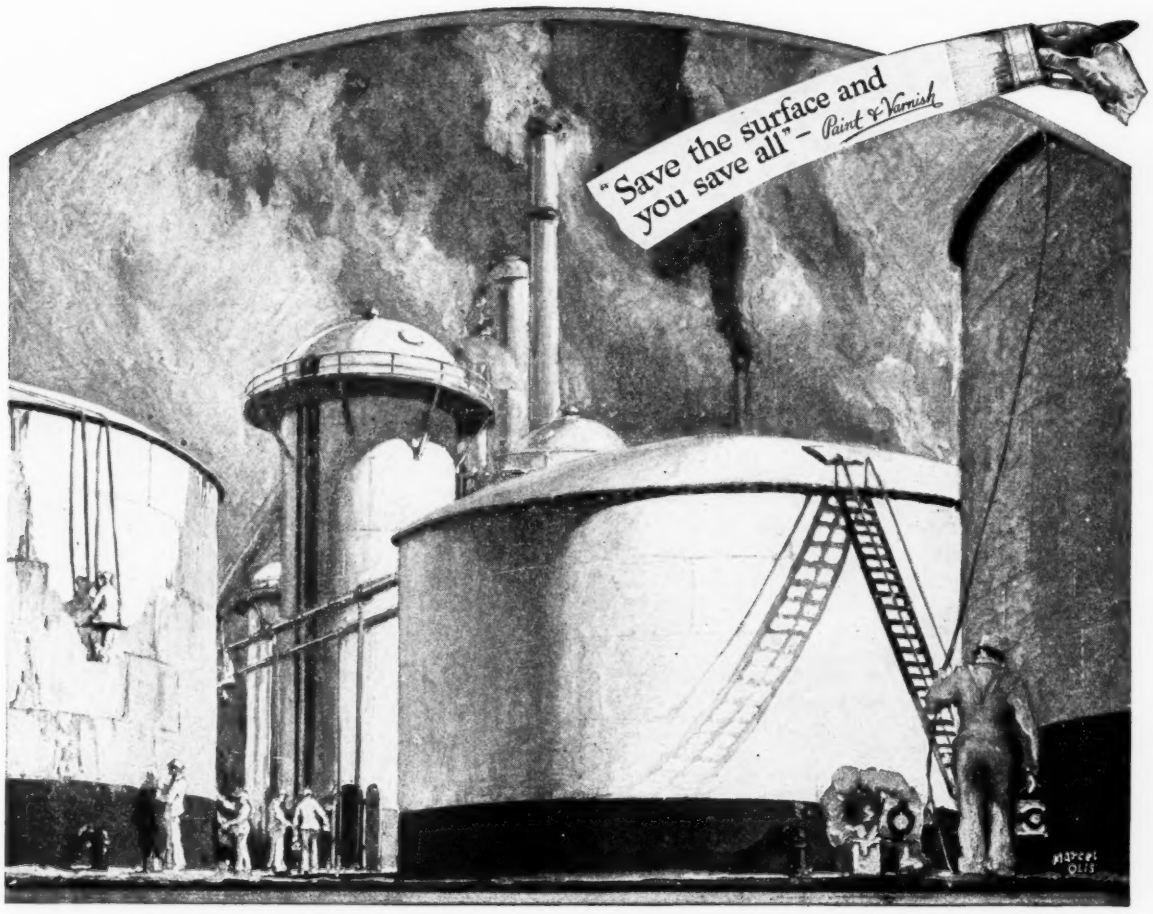


Fig. 3

When the softening capacity of the zeolite is exhausted, it is regenerated by passing through it a solution of sodium chloride, common salt. This removes all of the calcium and magnesium in the zeolite, leaving it in the original condition. The initial cost and operating cost of the zeolite is high. There is also the fact that caustic will form from the treated water. Experiments conducted by the University of Illinois indicate that caustic in water causes enbrittlement and subsequent cracking of steel boiler plate.

Lime-Soda Softener

The lime soda type of softener combines several features which when compared with other methods make it the



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preferred type of softener both from an operating and investment cost and from the results secured.

The lime-soda softener is made in two types—the intermittent and continuous. The intermittent method consists essentially of two tanks, the water being used alternately from each tank, while with the continuous method only one tank is used, the water entering it in the same amount as withdrawn. The tank is built large enough and designed to allow a considerable space of time for it to pass from the point where it enters the tank to the draw off pipe.

With the intermittent and continuous lime-soda softener the chemicals are added to the water, which, after being allow to stand for a period of from four to six hours to permit the chemicals to react on the hardening salts, is passed through a filter. After passing through the filter the water is soft, clear and correct for boiler feed use.

An improvement on the ordinary cold lime-soda process is the hot process developed by Graver Corporation, East Chicago, Indiana. In this softener, exhaust steam is used to heat the incoming raw (untreated) water. This is of value for two reasons. First, that the heat will cause the carbonates of calcium and magnesium to be thrown out of solution more completely, avoiding the tendency to "after precipitation." Second, the softened water can be delivered to the boiler at or near the boiling point. Each eleven degrees rise in the temperature means a saving of one per cent of fuel of any kind required. Before the exhaust steam passes into the heating chamber when it meets the incoming water it passes an oil separator which removes the oil that otherwise might cause foaming in the boiler. After the hot water leaves the heating chamber it passes into a mixing cone where it mixes with the chemical. This keeps all chemical reaction outside of the heater to avoid clogging.

Legend

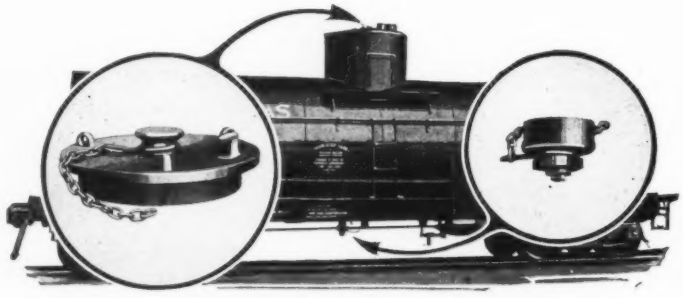
1. Raw hard water pipe.
2. U-tube pipe carrying water proportioned to control tank from Weir box.
3. Steam intake.
4. Swing-pipe outlet in the chemical tank.
5. Soft water line to make-up sump and float control valve.
6. Line carrying chemical from the pump to settling tank.
7. Downtake chamber.
8. Emergency pipe to sewer.
9. Sludge pipe to sewer.
10. By-pass for soft unfiltered water direct to boilers.
11. Oil drain to sewer.
12. Inlet for air wash to filter.

The control of the chemical added is absolute. By means of submerged orifices a certain amount of the incoming water is diverted to a chemical control tank. This addition of water causes a float to rise. This float is attached by means of a chain to a swing pipe in the chemical tank. The raising float lowers the swing pipe allowing the chemical solution to flow into a soft water dilution chamber from which it is taken by pump to the mixing chamber. The chemical which is not soluble in water is kept in uniform suspension by constant agitation with paddles while baffles prevent any swirling.

After leaving the mixing cone the mixture of chemical and water passes downward to the bottom of the tank. It requires one hour with the softener operating at maximum, rated, capacity for the water to pass from the bottom of this downtake to the outlet pipe of the settling tank. This allows complete reaction and settling time as heat very materially increases the rate of softening action of the chemical and settling of the sludge. On leaving the reaction chamber, the hot softened water passes through a Graver quartz filter which removes the last traces of solid matter, delivering water to the boiler, soft, clean and heated to within a few degrees of boiling. The water from this softener is guaranteed not to form scale, to cause no foaming and to be slightly alkaline under all conditions. Being alkaline no acid can be present to corrode the plates and the tubes.

Savings of Correct Water

It is not necessary to accept scale formation, constant blowdowns, etc., as a necessary evil. Neither is it necessary to pipe water for miles because water at location is unfit for use. Any water will make a satisfactory boiler feed water unless initially it is exceedingly high in sodium (non-incrusting salts) or over 40 to 50 grains per gallon hard. One plant which installed a softener of the type described above is saving on fuel alone over $35,000 annually. But fuel is not the only saving. Labor costs are reduced, investment decreased, replacement charges reduced until the net saving of a correct water softening system will pay its cost within a very short time. Extra, "stand-by" boilers are not needed when all regularly operating equipment is delivering capacity continually.



DOME COVERS AND OUTLET CAPS

Are you well supplied with Dome Covers and Outlet Caps? If not, don't put off ordering until the day you want to use them. The lack of ONE Outlet Cap might hold up loading and delivery for several days.

Our large and complete stocks of Dome Covers and Outlet Caps, combined with our close proximity to all fields makes us well suited to handle your business. May we have an order from you?

We manufacture: Centrifugal Pumps, Gray Iron Castings, Boiler Cleaners, Counter Shafts, etc. Among our specialties are: Machinery Repairing, Plate Work, Structural Steel and Cylinder Reboring.

Oil Well Rig Irons and Refinery Equipment

Western Iron & Foundry Co.

Wichita, Kansas

"You are hitting the nail on the head with your articles"—

writes a refinery superintendent of a foreign refinery in his subscription.

Calls for back issues of THE REFINER and NATURAL GASOLINE MANUFACTURER, which have exhausted our supply of back issues, indicate that the editorial content of the publication has a real value.

The REFINER and NATURAL GASOLINE MANUFACTURER is published for the man engaged in the operating branch of the refining and natural gasoline business and is edited through the assistance of a number of the best known refinery men in the United States.

If you are not a subscriber in your name, fill out the blank and attach your check or a dollar bill to it and send it in for a year's subscription.

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Name.....

Street and No.....

City.....

State.....

Refinery
Executive
Superintendent

Natural Gasoline Plant
Executive
Superintendent

(BE SURE TO CHECK CLASSIFICATION)

PERSONNEL OF THE INDUSTRY

CHARLES K. FRANCIS
Vice President and in charge of refineries for the Producers and Refiners Corporation

O. J. Tuttle of the Empire Refineries Inc., sales department, has been promoted to sales manager of the Cities Service Refining Company with headquarters in Boston.

John D'Arcy, general manager of the Liberty Refining Company at Pittsburgh, has returned from a motor trip through the eastern states.

M. L. Berryman of the Joliet Refining Company has returned to Joliet after visiting the Mid-Continent section.

S. C. Collins, vice president of the Marland Refining Company, Ponca City, Oklahoma, has been in Chicago for several days at the offices of the company.

Charles P. Clayton, who has resigned as vice president of the Caddo Central Oil and Refining Company, has left Shreveport for Dallas to manage his own company, the Clayton Oil and Refining Company.

The New England Oil Refining Company at Boston is moving about 600,000 barrels of California crude per month to its refinery in Massachusetts.

H. M. Larkum, secretary and treasurer for the Sunshine State Oil and Refining Company of Wichita Falls, Texas, departed early in August on a business trip to Minnesota and other nearby states.

J. M. Danziger, vice president of the Pan-American Petroleum and Transport Company, is in Los Angeles inspecting the company's new refinery and pipe line that have just been completed.

F. H. Adams, in charge of the construction work and gasoline recovery plant sales of the Kopper Company, has resigned to go into business for himself.

Dr. F. D. Hines, president of the Southern Oil and Refining Company, is spending several weeks in the Cumberland County, Kentucky, oil fields.

E. C. Marshall, superintendent of the refineries for the White Eagle Oil and Refining Company, and S. W. Irwin, engineer in charge of construction for the company, are on a visit to Casper, where the company is building a new refinery.

E. L. Mott, sales representative of the Deepwater Refineries in Houston, has returned from a two weeks' vacation spent in the East.

R. B. Miller, traveling representative of the Miller Petroleum Company, has been appointed sales manager of the Dallas office.

L. M. Lingenfelter, formerly manager of the Dallas sales office of the Miller Petroleum Company, has been appointed sales manager of Minnesota, Illinois, Wisconsin and Michigan.

L. J. Barrett, purchasing agent of the Pure Oil Company, has resigned to go into business for himself.

Col. A. E. Humphreys, of the Humphreys Oil Company, has left Mexia for Denver, where he will spend his vacation.

T. F. Hedgins of the C. & G. Cooper Company, visited Casper, Wyoming, recently to handle several big contracts which are now pending in the Rocky Mountain district.

B. W. Musser has been appointed general superintendent of operations for the Utah Oil Refining Company in Wyoming.

W. G. Skelly, president of the Skelly Oil Company, is on a visit to New York.

J. G. Phinney, cost engineer of the statistical division of the Empire Companies, Bartlesville, has been transferred to Tulsa, where he will work as lubrication engineer for the company.

F. L. Miller of the Miller Petroleum Company has been in Wichita recently visiting the refinery.

H. E. Johnson, vice president of the Producers and Refiners Corporation, has returned to Chicago from a trip through the West where he has been inspecting company holdings.

David M. Harris has been made treasurer of the Empire Oil Companies, succeeding R. C. Russum, who has charge of the Securities department of the Henry L. Doherty Company.

W. B. Hamilton, president of the Texhoma Oil and Refining Company, was stricken with a severe attack of appendicitis while on a business trip to New York. He was taken to Battle Creek, Michigan, where he is reported to be doing well.

R. R. Irwin, vice president of the White Eagle Oil and Refining Company, is in Casper, Wyoming, where the company is building a refinery.

A. D. Smith, refinery engineer, is in England directing the construction of a 15,000 barrel refinery on the Thames River.

C. E. Craig, secretary of the Miller Petroleum Company, has been in St. Louis active in the organization of refinery credit men. The refinery credit men are planning a meeting for the near future.

William Polje, advertising manager of the Skelly Oil Company, recently conducted a sales trip by aeroplane. He covered Skelly sales territory in Tennessee, Mississippi, Kentucky, Alabama, Iowa, South Dakota, Minnesota and Nebraska; a 3000 mile trip in 10 days.

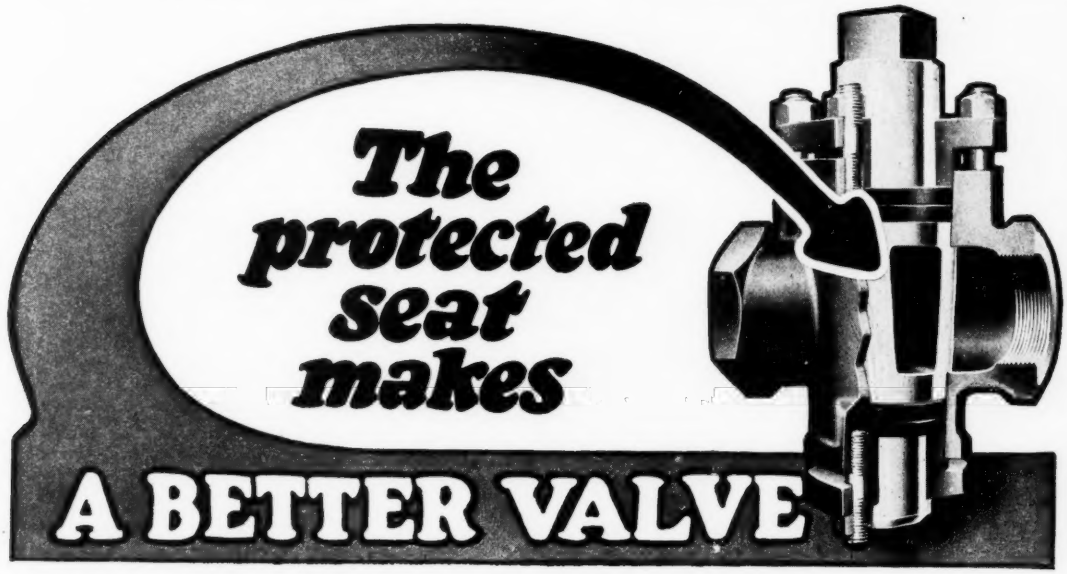
B. E. Buchanan of Springfield, Missouri, visited his son, D. E. Buchanan of Tulsa, Oklahoma, during July. D. E. Buchanan is vice president of Chestnut and Smith Corporation and is head of the Association of Natural Gasoline Manufacturers.

M. L. Berryman of the Joliet Refining Company has returned to Joliet, Illinois, after a trip through the Mid-Continent refining district in the interest of company business.

C. A. Willis, who has been connected with the sales department of the Empire Refineries, Inc., has been promoted to the position of assistant sales manager with headquarters at Tulsa, Oklahoma.

VICTORY

FcH DOUBLE PACKED STOP COCK VALVES



THE seats of a stop-cock valve are protected as long as the plug remains seated. In the Victory Double Packed Stop Cock Valve, the plug STAYS seated. Correct adjustment is inherent in this improved plug type valve. The plug is cushioned between two stuffing boxes. The ready adjustment provided by the two glands avoids the necessity of raising the plug from its seat every time the valve is operated. The result—a valve ready to operate at any time, and positive in action.

Corrosion, or long periods of disuse, may stick any valve. Even in such an extreme case, the Victory Double Packed valve is absolutely dependable. Jar the plug loose by striking the lower stem. The plug is freed, but the packing at the top has absorbed the shock and has kept the plug in place.

These features, and a close attention to strength and proper proportioning, result in a valve which gives remarkable service under unusual circumstances.

Send for Our Complete Catalog

Victory Manufacturing Company

100 Main Street

NILES, CALIFORNIA

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NORVEL-WILDER HARDWARE CO., Beaumont and Houston, Texas
ENGINEERING EQUIPMENT CO., 817 Union League Bldg., Los Angeles, Calif.

Gasoline Men Believe That Conditions Of Industry Better Than in Many Months

Tulsa, Okla.—That a more satisfactory condition prevails in the natural gasoline industry at this time with respect to output and available market than for some months past was the concensus of opinion as expressed at a conference of members of the Association of Natural Gasoline Manufacturers held here August 1 and attended by representative men in the industry from various sections of the Mid-Continent.

As a means of better acquainting the jobbing and consuming trade with the advantages of natural gasoline as related to properly blended motor fuel a weekly letter is being sent out that is accomplishing much toward the end sought. Supervision of issuing the weekly trade letter is in the hands of A. V. Bourque, secretary of the association.

Stocks of natural gasoline were reduced considerably during July, according to reports made by manufacturers of the product, and probably 50 per cent of the gasoline in storage 30 days ago has been moved by now. Of the 12,000,000 gallons in storage the latter part of May there only remained something like 6,000,000 gallons on August 1. A considerable portion of this stock is held by the larger manufacturing interests who have an outlet for much of their product by contract and who are indisposed at this season to greatly reduce their accumulation.

A good indication of improvement in the natural gasoline market is the strength denoted in current refined oil quotations. Natural gasoline and blends have not weakened during the last two or three weeks in proportion to straight run stuff, which has sagged to a new low level.

"New Era" Gasoline-Water Separator

Automatically and continuously discharges water from Gasoline Stills as it enters the Separator.

Keeps Still at its maximum capacity.

Eliminates the use of a Settling Tank.

Saves gasoline now wasted by hand-operated valves.

No repairs or renewals necessary.

Removes a great fire hazard.

Unconditionally Guaranteed.

Send us your maximum capacity required and pressure.

VALVE ENGINEERING COMPANY

66-72 Hamilton Street, Cambridge, Mass.

Move West Texas Plant From Stevens County to Strawn

Breckinridge, Tex.—The 5,000,000 cubic foot daily absorption gasoline manufacturing plant formerly operated on the J. C. Hale lease in Stephens County by the Hydro-Carbon Products Company is being dismantled and shipped to the Strawn field in Palo Pinto County, where it will be re-built and operated on gas contracted for with the Texas Pacific Coal & Oil Company from about 80 shallow wells. The Hydro-Carbon Products Company was recently merged into the Majestic Gasoline Company of Texas, and will operate in the future under the latter name. Headquarters are maintained in Fort Worth.

The plant was moved from Stephens County because of exhaustion of gas fields in its vicinity. It is reported that the gasoline yield from gas in the Strawn field amounts to about 2 gallons per thousand cubic feet.

Kaw Boiler Works Gets Contract on New Plant

Casper, Wyo.—Contracts for tankage and certain other equipment work at the new refinery to be built near here by the White Eagle Oil and Refining Company has been let to Kaw Boiler Works Company of Kansas City, Kansas, and the Hammond Iron Works of Warren, Pennsylvania.

A group of White Eagle officials including R. R. Irwin, vice president in charge of refining; E. C. Marshall, refinery superintendent, and W. E. Dickerson, refinery engineer, have been on the ground here in connection with the construction work.

Refrigeration Information Free From United Iron Works

Free information to any one interested in mechanical refrigeration or ice making equipment, has been offered by The United Iron Works, Inc., of Kansas City, Missouri. Upon application, complete data and catalogs covering any particular branch of the industry will be furnished.

During the last 30 years, "Sterling" refrigerating and ice making equipment, manufactured by the United Iron Works, has demonstrated its durability, dependability and economy, and many large installations have been made.

Requests for information should be addressed to United Iron Works, Inc., 302 Ridge Arcade Building, Kansas City, Missouri.

Fredonia, Kans.—Operations at the Red Bird Refining Company's plant here may start up within a short time. The plant has undergone repairs and is in good condition. The plant has a rated capacity of 800 barrels daily.

Many who think about cracking think only of gas oil, and then only with low carbon content

Use the cheapest product in your refinery or buy the other fellow's; run it through the Dubbs Cracking Process, and laugh at the refiner who pays a premium for high gravity crude to get his gasoline, while you are getting 40 per cent or more from topped oil, fuel oil or low grade crude, in each throughput

Universal Oil Products Company
Owners of the Dubbs Process
208 South La Salle Street Chicago

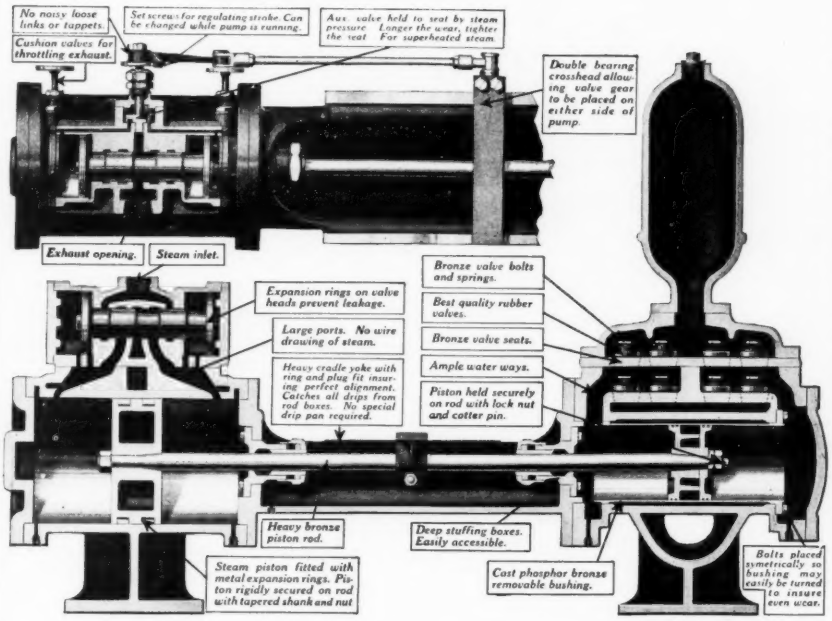
Mid-Continent Refinery Operations

AS OF AUGUST 15, 1923

Company and Location	Daily Capacity	Now Running
Missouri—		
C. & G. Refining Co., Centropolis	400	SD
Ford Oil & Refining Co., Kansas City	500	SD
Standard Oil Co. of Indiana, Sugar Creek	12,000	8,500
St. Joseph Viscosity Oil Co., St. Joseph	500	RRC
Wilhoit Refining Co., Joplin	2,000	850
Kansas—		
Associated P. & R. Co., El Dorado	1,000	SD
Bell Producing & Refining Co., Wichita	700	SD
Commonwealth Oil & Refining Co., Moran	800	200
Derby Oil & Refining Co., Wichita	5,000	2,400
Chemical Oil & Gas Co., Osawatomie	1,000	SD
El Dorado Refining Co., El Dorado	4,000	1,600
Mecca Refining Co., Augusta	2,500	SD
Fontier Refining Co., Hutchinson	2,000	850
Fugatt Giles Corporation, Wichita	100	SD
Golden Rule Refining Co., Wichita	800	825
Great Western Refining Co., Erie	1,500	SD
Great Western Petroleum Co., Florence	2,000	SD
H. & H. Refining Co., Osawatomie	1,600	SD
Imperial Refining Co., Cherryvale	2,400	SD
Kanotex Refining Co., Arkansas City	3,000	2,800
Kansas Oil Refining Co., Coffeyville	2,000	550
Kansas City Refining Co., Kansas City	5,000	2,200
Kansas-Texas Oil Refining Co., Wichita	1,500	SD
Lesh Refining Co., Arkansas City	1,500	800
Lakeside Refining Co., Augusta	2,500	600
Midland Refining Co., El Dorado	8,000	5,550
Mutual Oil Co., Chanute	1,500	425
Marshall & Co., Sheffield	2,500	SD
Moore Refining Co., Arkansas City	4,500	3,800
Mo-Kan Refining Co., Kansas City	1,000	SD
McCree Petroleum Co., Baxter Springs	600	SD
McWhorton-Chanute Refining Co., Chanute	200	SD
Miller Petroleum Co., Humboldt	1,500	700
National Refining Co., Coffeyville	5,000	4,700
North American Refining Co., Rosedale	700	SD
Peerless Oil & Refining Co., Chanute	2,500	1,750
Interstate Refiner, Inc., Centropolis	1,000	SD
Richardson Refining Co., El Dorado	2,000	600
Sinclair Refining Co., Coffeyville	7,000	4,600
Red Bird Refining Co., Fredonia	800	SD
Sinclair Refining Co., Argentiste	6,000	6,000
Sterling Oil & Refining Co., Wichita	5,000	3,900
St. Louis Oil & Refining Co., El Dorado	1,500	SD
Standard Oil Co., (Kansas) Neodesha	12,000	8,600
Vickers Petroleum Co., Potwin	1,800	600
White Eagle Oil & Refining Co., Augusta	6,000	6,000
Oklahoma—		
Acme Refining & P. L. Co., Jennings	2,600	SD
Allied Refining Co., Okmulgee	2,000	900
Associated P. & R. Co., Yale	1,000	SD
Barnsdall Refining Co., Barnsdall	3,000	2,600
Bay State Refining Co., Healdton	1,000	SD
Beaver P. & R. Co., Dilworth	700	SD
Bison Refining Co., Quay	1,000	SD
Bolene Refining Co., Enid	3,600	1,500
Buffalo Refining Co., Yale	1,000	SD
Cushing Refining Co., Cushing	1,000	850
Cameron Refining Co., Ardmore	3,500	2,100
Canfield Refining Co., Yale	500	100
Carter Oil Co., Carteco	12,000	SD
Champlin Refining Co., Enid	15,000	5,000
Cherokee Refining Co., Oilton	1,000	SD
Chestnut & Smith Corp., Sand Springs	5,000	SD
Choat Oil Corp., (Now owned by Charles F. Noble) Oklahoma City	2,200	SD
Coleman Nelson Corp., West Tulsa	2,600	SD
Coleman Nelson Corp., Haskell	1,000	SD
Constantine Refining Co., Devol	10,000	SD
Constantine Refining Co., West Tulsa	4,500	SD
Cosden & Co., West Tulsa	35,000	SD
Cushing Refining & Gasoline Co., Cushing	2,500	1,600
Cyril Refining Co. (Apex Pet. Co.), Cyril	1,200	400
Daisy Bell Petroleum, Wilson	2,000	200
Camascue Refining Co., Lawton	1,500	SD
Cushing Refining & Gasoline Co., Blackwell	1,500	1,200
El Dorado Refining Co., Yale	700	SD
Equality Refining Co., Oilton	1,000	SD
Empire Refiners Inc., Cushing	5,000	3,100
Empire Refineries, Inc., Okmulgee	2,500	1,700
Empire Refineries, Inc., Oklahoma City	2,500	SD
Empire Refineries, Inc., Ponca City	4,500	3,400
Frances Refining Co., Frances	5,000	SD
Frederick Refining Co., Frederick	5,000	SD
Fairmont Refining Co., Fairmont	2,500	700
Federal Oil & Refining Co., Cushing	1,500	SD
Globe Oil & Refining Co., Blackwell	4,000	3,000
Gilmer Oil Co., Ringling	800	200
Golden Belt Refining Co., Oklahoma City	200	SD
Grandfield Oil & Refining Co., Grandfield	3,000	1,200
Great American Refining Co., Jennings	2,500	SD
Hewitt Refining Co., Hewitt	1,600	1,000
Home Oil & Refining Co., Yale	2,000	SD
Indian Oil & Refining Co., Cushing	1,800	SD
U. S. Cities Corp., Bristow	2,500	SD
Imperial Refining Co., Ardmore	5,000	4,000
Indiahoma Refining Co., Okmulgee	9,000	SD
Illinois Oil Co., Cushing	3,000	1,500
Inland Refining Co., Cushing	3,000	1,200
Johnson Oil Refining Co., Cleveland	2,500	1,600
Lawton Refining Co., Lawton	1,000	SD
Livingston Refiners Corp., Walters	3,000	SD
Local Refining Co., Oklahoma City	1,000	600
Marland Refining Co., Ponca City	12,000	9,000
Marland Refining Co., Covington	1,000	500
Mecca Refining Co., Allen	1,500	SD
Meridian Petroleum Co., Okmulgee	3,000	SD
Meridian Petroleum Corp., Hominy	1,000	SD
Meridian Petroleum Co., Ponca City	2,500	SD
Mid-Co. Pet. Co., West Tulsa	7,000	SD
North American Refining Co., Pemeta	1,500	SD
Nyanza Refining Co., Wilson	3,500	500
Oil State Refining Co., Enid	2,500	800
Pontotoc Pipe Line & Refining Co., Allen	600	200
Omar Refining Co., Garber	2,500	1,650
Oklahoma P. & R. Co., Muskogee	2,500	1,600
Pawhuska Refining Co., Pawhuska	1,000	100
Waite Phillips Co., Okmulgee	3,000	1,600
Pierce Oil Corp., Sand Springs	9,000	5,000
Polar Producing & Gasoline Co., Sapulpa	2,000	SD
Producers & Refiners Corp., Blackwell	2,500	2,000
Producers & Refiners Corp., West Tulsa	6,000	4,050
Pure Oil Co., Ardmore	7,000	3,400
Pure Oil Co., Cushing	6,500	3,000
Pauline Refining Co., Hampton	1,200	500
Powerine Oil Co., Billings	500	SD
Pioneer Pet. Co., Guthrie	2,500	SD
Pirtle-Pittman Refining Co., Newkirk	2,000	200
Rock Island Ref. & P. L. Co., Duncan	1,200	900
Santa Fe O. & R. Co., Ardmore	5,000	SD
Shaffer O. & R. Co., Cushing	6,500	4,000
Sapulpa Ref. Co., Sapulpa	7,000	4,000
Southern Oil Corp., Yale	6,000	SD
Southern Oil Corp., Walters	2,500	SD
Sun Company, Yale	4,000	2,400
Southwestern Oil Corp., Enid	1,800	SD
Sinclair Ref. Co., Cushing	5,500	5,000
Sinclair Refining Co., Muskogee	2,000	1,000
Texas-Okla. Ref. Co., Grandfield	1,500	1,200
Texas Company, West Tulsa	8,000	7,200
Tidal Ref. Co., Drumright	4,500	3,800
Transcontinental Oil Co., Boynton	3,000	2,000
Transcontinental Oil Co., Bristow	5,000	4,700
Travis Senter Ref. Co., Commanche	1,500	650
Union Oil & Ref. Co., Grandfield	2,500	SD
Turley Ref. Co., Oklahoma City	2,500	SD
Wagoner Ref. Co., Wagoner	500	SD
Wilcox Ref. Co., Bristow	500	400
Yale Oil Corp., Yale	1,200	550
North Texas—		
American Oil Corp., Pioneer	2,500	1,000
American Ref. Co., Wichita Falls	5,000	4,400
H. E. Boner, Burkburnett	700	SD
The Petroleum Corp., Electra	2,000	500
Buffalo Ref. Co., Sherman	500	150
Burk-Texas Ref. Co., Burkburnett	1,200	SD
Bear Ref. Co., Burkburnett	1,200	SD
Clayton O. & R. Co., Dallas	3,500	200
Crystal Pet. Co., Burkburnett	1,000	300
Eastland-Pioneer O. & R. Co., Cisco	1,000	SD
Empire Refineries, Inc., Gainsville	7,000	3,850
General Refineries, Inc., Abilene	1,500	SD
Gulf Ref. Co., Fort Worth	15,000	5,600
Gorman Ref. Co., Gorman	1,000	SD
Griswold Ref. Co., Electra	2,000	1,600
Humble O. & R. Co., Burkburnett	1,500	1,200
Invincible Oil Corp., Fort Worth	5,000	SD
Interstate Gasoline Co., Iowa Park	2,000	800
Iowa Park Prod. & Ref. Co., Iowa Park	1,000	500
Keystone Ranger Ref. Co., Wichita Falls	2,000	SD
Lone Star Ref. Co., Wichita Falls	4,000	800
Manhattan Ref. Co., Burkburnett	3,000	SD
Manhattan Pet. Prod. Co., Wichita Falls	2,500	300

Legend Shutdown, SD; Running Reduced Crude—RRC.

American-Marsh Refinery Pumps


No noisy loose links or tappets.
Set screw for regulating stroke. Can be changed while pump is running.
Aux. valve held to seat by steam pressure. Longer the wear, tighter the seat. For superheated steam.
Cushion valves for throttling exhaust.
Double bearing crosshead allowing valve gear to be placed on either side of pump.
Exhaust opening.
Steam inlet.
Bronze valve bolts and springs.
Expansion rings on valve heads prevent leakage.
Best quality rubber valves.
Large ports. No wire drawing of steam.
Bronze valve seats.
Heavy cradle yoke with ring and plug fit insuring perfect alignment. Catches all drips from rod boxes. No special drip pan required.
Ample water ways.
Piston held securely on rod with lock nut and cotter pin.
Heavy bronze piston rod.
Deep stuffing boxes. Easily accessible.
Steam piston fitted with metal expansion rings. Piston rigidly secured on rod with tapered shank and nut
Cast phosphor bronze removable bushing.
Bolts placed symetrically so bushing may easily be turned to insure even wear.

The illustration tells its own story. Why the American-Marsh is the logical pump for use in your refinery.

Note the extra wide passages and large valve area which make them especially adapted for handling oil and other refinery products.

The line includes:

Centrifugal Pumps
Acid Pumps
Oil Pumps
Dry Vacuum Pumps
Air Compressors
Jet Condensers
Hydraulic Pressure Pumps

Catalog on Request

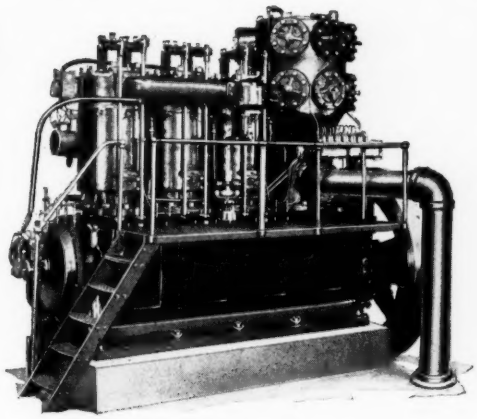
American Steam Pump Company

Battle Creek, Mich.

REEVES

VERTICAL

Self-Contained
Gas Engine Driven
Compressor Unit
Sizes up to 300 H. P.



Single Or Two Stage Compressor Cylinder

MAXIMUM EFFICIENCY

MINIMUM SPACE

PROVEN RELIABILITY

FOR FULL DATA WRITE OR WIRE

Consulting and Contracting Engineers in Natural Gas and Oil.

HOPE ENGINEERING & SUPPLY CO.
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REFINERY AND GASOLINE PLANT ACTIVITIES

American to Use Both Cross And Dubbs Units at Plant

Wichita Falls, Texas,—The American Refining Company, which is one of the largest independent refiners in this district, is installing both the Dubbs and Cross cracking processes in connection with its 5,000 barrels daily capacity skimming plant located north of Wichita Falls. Four units of the Dubbs process and two of the Cross are now under construction, and when completed will represent an investment of approximately $450,000. Two of the Dubbs units will be ready for operation within 60 days.

The American Refining Company is the only independent concern in Texas to make use of two separate cracking processes, and has spent a large sum in studying and investigating the various processes now on the market. The Dubbs is to be used largely to crack the fuel oil turned out by the skimming plant, while the Cross system will handle distillates and other lighter grades of by-products. The skimming plant is now in operation to capacity, and when the two cracking systems are completed the owners are contemplating a daily output of 3,000 barrels of navy gasoline.

Dubbs Cracking Units to Be Used by Nippon Oil Co.

Chicago, Ill., July 30.—Installation of the Dubbs system of gasoline cracking in the plant of the Nippon Oil Company, marks the introduction of cracking processes into Japan. Mr. O. H. Fairchild of the Universal Products Company left Chicago on August 1, for Japan to establish the unit.

May Build Gasoline Plant To Use Haynesville Gas

Haynesville, Louisiana—The Gilliland Oil Company is reported to have appropriated funds to erect a natural gasoline manufacturing plant to extract the gasoline from the gas from its various leases in the Haynesville field. It is planned to use the absorption process, and the plant will have a capacity of about 5,000,000 cubic feet daily. Orders for the material have not been placed.

Interstate Buys Property of Ranger Company at K. C.

Kansas City, Mo.—Interstate Refineries Corporation has purchased the property of the Ranger Refining and Pipe Line Company of Texas for a reported consideration of around $300,000. The sale is to be approved by court order. It is understood the purchasers intend to remodel the plant and will install a cracking process and resume operations. W. D. Girard of Abilene, Texas, trustee of the Ranger concern, negotiated the deal for that company.

Several New Gasoline Plants for Oklahoma

Tulsa, Okla.—A two unit gasoline plant is being constructed on the old Suppes ranch, south of Tulsa, by the Continental Gasoline Production Company of Kansas City. Other construction in the state includes a six unit absorption plant for McCaskey and Wentz of Ponca City on the McKee farm in Kay County. The equipment of this plant will consist of six 80 horsepower Bessemer direct driven compressor units.

The Skelly Oil Company is building an absorption plant near Maramec in Pawnee County that will be equipped with five 80 horsepower Bessemer direct driven compressor units.

New Concern Starts Work on West Texas Skimming Plant

Wichita Falls, Texas.—Erection of a 1,000 barrel daily capacity skimming plant is now in progress by the Megargel Oil and Refining Company near the town of Megargel in Archer County. The plant is located on the A. J. Lowe land along the G. T. & W. railroad, and about two miles south of the Swastika oil field, which will supply the crude for operations. Crude produced in this field tests 40 degrees gravity and better, and at present is without a market because none of the major pipe line companies have entered the field with their lines. It is planned to have the plant in operation by September 1, and it will cost approximately $30,000. The Megargel Oil and Refining Company is capitalized at $20,000, and has been granted a state charter, with headquarters established at 700 City National Bank building, Wichita Falls. E. Constantin Jr. and F. W. Fisher are at the head of the organization, and the former will be plant superintendent.

Shreveport, La.—Good progress is being made by the Shreveport Producing and Refining Corporation on the erection of two units of the Dubbs cracking process being installed in conjunction with its 4500 barrel daily capacity skimming plant located at Jewella, near Shreveport.

Company and Location	Daily Capacity	Now Running
Miller Pet. Co., Wichita Falls	2,500	1,500
Magnolia Pet. Co., Fort Worth	12,500	5,500
Noble O. & G. Co., Burkburnett	5,000	800
Nortex Ref. Co., Burkburnett	2,000	700
North Texas Ref. Co., Greenville	1,000	SD
Owenwood Oil Corp., Burkburnett	2,000	SD
Oriental Ref. Co., Dallas	5,000	500
Odessa Ref. Co., Ranger	1,000	SD
Orient Pet. Co., Wichita Falls	2,000	400
Pierce Oil Corp., Fort Worth	10,000	SD
Panhandle Ref. Co., Wichita Falls	4,500	3,200
Atlas Ref. Co., Fort Worth	2,000	SD
Primrose Ref. Co., Wichita Falls	1,500	400
Interstate Refineries, Inc., Ranger	2,500	SD
Haggeman Ref. Co., Tiffin	2,000	200
Star Ref. Co., Fort Worth	1,500	400
State Ref. Co., Dallas	1,000	200
Sunshine State Ref. Co., Wichita Falls	2,500	1,800
Tidal Western Ref. Co., Burkburnett	3,000	1,200
Texas Company, Dallas	15,000	7,500
Texhoma O. & R. Co., Wichita Falls	4,500	2,000
Transcontinental Oil Co., Fort Worth	5,000	1,650
Travis Refining Co., Burkburnett	1,000	250
Great Texas Ref. Co., DeLeon	700	SD
Uniform Pet. Co., Burkburnett	4,000	SD
Virginia Ref. Co., Dublin	4,000	SD
Victor Ref. Co., Burkburnett	2,000	SD
Wagoner Ref. Co., Electra	3,000	600
Walker Consolidated Ref. Co., Iowa Park	2,500	SD
White Eagle O. & R. Co., Fort Worth	5,000	SD
Waco Ref. Co., Waco	500	SD
World Ref. Co., Bridgeport	800	SD

Company and Location	Daily Capacity	Now Running
North Louisiana—		
Caddo Central O. & R. Co., Shreveport	3,500	SD
Caddo Central O. & R. Co., Shreveport	7,000	5,000
Crescent O. & R. Co., Cedar Grove	800	SD
Homer Ref. Co., Homer	250	SD
International O. & R. Co., Shreveport	800	SD
Leeton Refining Co., Shreveport	800	SD
Louisiana Pet. Prod. Co., Bossier	300	SD
Louisiana O. R. Co., Shreveport	9,000	4,700
Paramount Pet. Co., Superior	3,000	SD
Red River Ref. Co., Chrichton	1,500	1,200
Rodgers Ref. Co., Shreveport	1,500	SD
Shreveport O. & R. Co., Shreveport	4,500	3,500
Texas Company, Arlda	5,000	4,000
Union Ref. & P. L. Co., Oil City	1,000	SD
Union Ref. & P. L. Co., Homer	1,000	SD
Arkansas—		
Abner Davis, El Dorado	60	SD
Airedale Ref. Co., El Dorado	1,000	SD
Arkansas Ref. Co., Fort Smith	1,000	SD
Arkansas P. & R. Co., El Dorado	1,000	800
El Dorado P. L. & Ref. Co., El Dorado	2,000	SD
Grison Ref. Co., El Dorado	750	SD
Jones Bros. & Tatum, El Dorado	1,000	400
Kettle Creek Ref. Co., Pearson	2,000	1,500
Lions O. & R. Co., El Dorado	5,000	4,000
Pine Bluff Ref. Co., Pine Bluff	1,000	800
Root Refineries, El Dorado	3,000	1,100
Shippers Pet. Co., El Dorado	1,800	400
Union P. L. & Ref. Co., El Dorado	4,000	800
The Arkansas Ref. Co., Riodron	3,000	SD
Farmer O. & R. Co., Texarkana	1,000	200
Four States Ref. Co., Texarkana	400	SD

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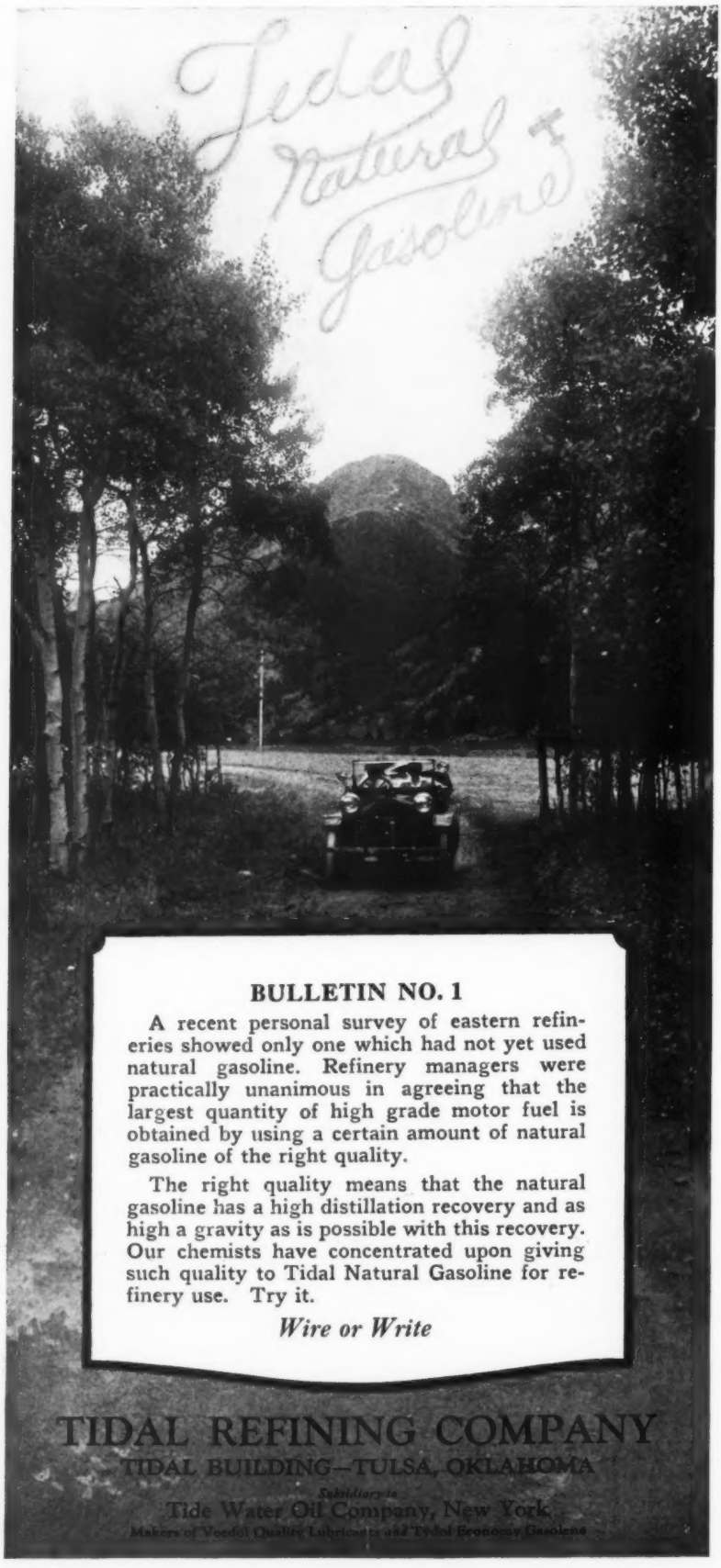
UNION STEAM PUMP CO.

BATTLE CREEK, MICH.


Tidal
Natural
Gasoline
BULLETIN NO. 1
A recent personal survey of eastern refineries showed only one which had not yet used natural gasoline. Refinery managers were practically unanimous in agreeing that the largest quantity of high grade motor fuel is obtained by using a certain amount of natural gasoline of the right quality.
The right quality means that the natural gasoline has a high distillation recovery and as high a gravity as is possible with this recovery. Our chemists have concentrated upon giving such quality to Tidal Natural Gasoline for refinery use. Try it.
Wire or Write
TIDAL REFINING COMPANY
TIDAL BUILDING—TULSA, OKLAHOMA
Subsidiary to
Tide Water Oil Company, New York
Makers of Veedol Quality Lubricants and Tydol Economy Gasolene

Magnolia Makes Complete Plant at Hodge Station

Fort Worth, Texas.—Conversion of the 10,000 barrel daily capacity topping plant operated by the Magnolia Petroleum Company at Hodge Station near Fort Worth into a refinery was completed late in July, and the company is now able to make shipments of all grades of gasoline and kerosene from this plant. Agitators and additional stills were installed, as well as more tankage for high gravity oils. Magnolia has been only topping the crude run through the plant, selling the fuel oil to railroads and industrial plants in North Texas, and piping the "light stuff" to its refinery at Beaumont, where it was re-run and then cracked.

Czecho-Slovak Endorses New Product as Gas Substitute

Washington, D. C.—Orders specifying the use of Dynalkol in the operation of government automobiles, trucks and other motor equipment have been issued by the Czecho-Slovak ministry of national defense, according to advices just received in the petroleum division of the Department of Commerce. Dynalkol, it is stated, is a composite motor fuel, consisting of 60 parts benzol and 40 parts alcohol, a domestic product which is sold at a considerably lower price than gasoline.

In view of its endorsement by the government as a substitute for gasoline, the report states, dynalkol promises to become an important development of the domestic motor-fuel and alcohol industries.

Material Is Moved in for Corsicana Gasoline Plant

Corsicana, Texas. — Materials are moving in for the erection of the first natural gasoline plant for the Corsicana-Powell field. The Humble Oil and Refining Company is to build this plant on the southwest end of the field on its Garland C. Kent lease, where the gasoline content of the gas from producing wells tests about two gallons per thousand cubic feet. The first unit of the plant will have a daily capacity of 5,000,000 cubic feet, and will use a straight mineral seal absorption process. It is to cost approximately $250,000, and will be in operation within three months. The plant is being constructed so that additional units can be added, and it will be multiplied in size several times over before the end of the year if the gas pressure holds up in this section of the field.

State Refining Company Holds Annual Election of Officers

Dallas, Texas.—The annual election of officers for the State Refining Company which is operating an 1800-barrel refinery at Grand Prairie, was held here early this month. The following were chosen: Shearon Bonner of Dallas, president; Dan Hobrecht of Dallas, Knox Henderson of Athens and T. E. May of Clarkville, Arkansas, vice presidents; and S. F. Semo, secretary and treasurer.

natural gasoline

grade "a"

GRAVITY.....Not below 72° Be.
Not above 78° Be.
E. P.....Not over 375° F.
RECOVERY.....Not less than 90%

grade "b"

GRAVITY.....Not below 76° Be.
Not above 82° Be.
E. P.....Not over 375° F.
RECOVERY.....Not less than 85%

grade "c"

GRAVITY.....Not below 80° Be.
Not above 88° Be.
E. P.....Not above 350° F.
RECOVERY.....Not less than 78%

grade "d"

GRAVITY.....Not below 88° Be.
Not above 92° Be.
E. P.....Not above 350° F.

The rush of a big summer gasoline demand is here. A heavy demand naturally causes a rise in prices.

Do not wait too long and allow the prices to advance before you protect your summer's requirements of Natural Gasoline.

Our large production, storage and car supply put us in a position to serve you promptly at all times.

CS INCORPORATED

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GRAVITY.....Not below 58° Be.
Not above 62° Be.
E. P.....Not over 437° F.
RECOVERY.....Not less than 91%

grade "2"

GRAVITY.....Not below 58° Be.
Not above 62° Be.
E. P.....Not over 450° F.
RECOVERY.....Not less than 90%

grade "3"

GRAVITY.....Not below 64° Be.
Not above 66° Be.
E. P.....Not over 440° F.
RECOVERY.....Not less than 88%

grade "4"

GRAVITY.....Not under 66° Be.
Not over 70° Be.
E. P.....Not over 435° F.
RECOVERY.....Not less than 8[illegible]%

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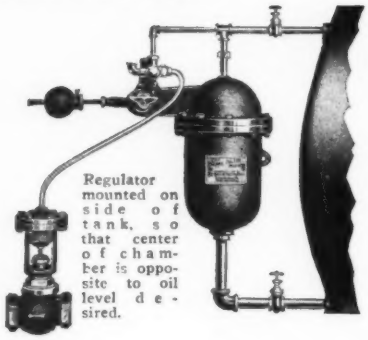

Regulator mounted on side of tank, so that center of chamber is opposite to oil level desired.

In manufacturing gasoline by absorbing it in oil and then separating by distillation, a constant oil level must be maintained in both absorbing tank and still.

The Vigilant Regulator maintains a constant level under all temperatures and pressures.

Constructed to control the outlet flow of oil from an absorber, but can be constructed to control the inlet flow.

Write for full information and prices.

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TULSA BOILER & SHEET IRON WORKS

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A New Name for an Old Friend

WHAT'S in a name, anyway? The refinery construction work we are doing under the name "Pioneer" is just the same high grade as when it bore the name "Tulsa Boiler and Sheet Iron."

For eighteen years, as the "Tulsa Boiler and Sheet Iron Works" we have turned out tanks and refinery steel construction that made good friends for us among the wise buyers of the Mid-Continent. We pioneered in giving these people "close to home" service on the best kind of work.

Now, under the new name, The Pioneer Tank and Boiler Company, we're all set with the men, machinery and money to keep on growing under the Pioneer banner like we did when Tulsa Boiler and Sheet Iron was on our letterhead.

There is no change in our organization.

Get Pioneer quotations on tank and refinery construction work.

PIONEER TANK & BOILER COMPANY
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Box 1926, TULSA, OKLA.

Indian Commissioner Takes Up Royalty Payment Change

Washington, D. C.—Commissioner of Indian Affairs Charles N. Burke has taken under advisement the petition of Mid-Continent oil men and natural gasoline manufacturers for a revision of regulations governing payment of royalties on gas produced in the Osage Nation, Oklahoma.

A committee made up of the following appeared before the commissioner: John Kane of the Phillips Petroleum Company of Bartlesville, Oklahoma; W. P. Z. German of Skelly Oil; J. H. Welch of Tidal Refining; A. T. Scherer of Sinclair Oil and Gas; J. D. Iams of Gypsy Oil and Judge Harry H. Smith, secretary of the Osage Lessees Oil and Gas Association, all of Tulsa, Oklahoma.

Two More Units for Brooks And Hanlon West Texas Plant

Breckenridge, Texas. — Two more units are being added to the natural gasoline manufacturing plant operated by Brooks & Hanlon Inc., (Chestnut & Smith) on the Walker & Caldwell lease in Stephens County. This plant is using a combination of both absorption and compression process, and will have a total of 17 units in the plant and in the field when the two new ones are completed. It is reported that four more units are contemplated. This plant is making close to 30,000 gallons of natural gasoline daily and at present has a greater output than any other single plant in Texas.

Two Gasoline Manufacturers Merge California Properties

Fort Worth, Texas.—Because of the stocks being owned largely by the same parties in California, the properties of the Cremer-Martin Gasoline Company and the Hydro-Carbon Products Company have been merged, and will be operated in the future as the Majestic Gasoline Company of Texas. The latter concern has just been granted a charter under the laws of Texas, and has a capital stock amounting to $250,000. Headquarters will continue on the twelfth floor F. & M. Bank building in Fort Worth. The Cremer-Martin Company has a compression plant in the Desdemona field, while the Hydro-Carbon Company's plant has been operating in Stephens County, Texas.

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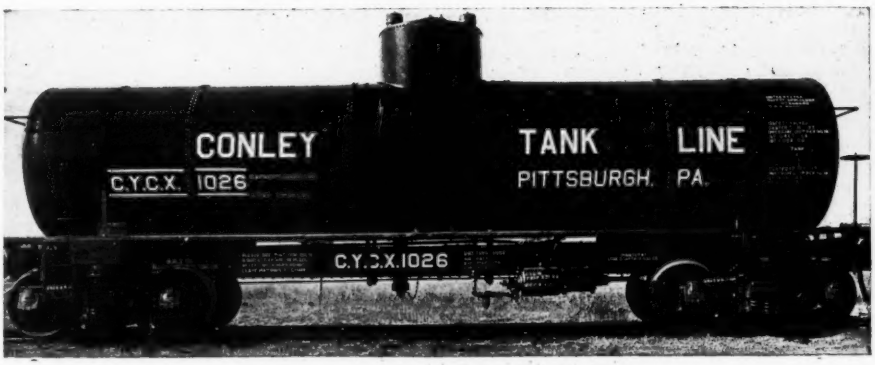

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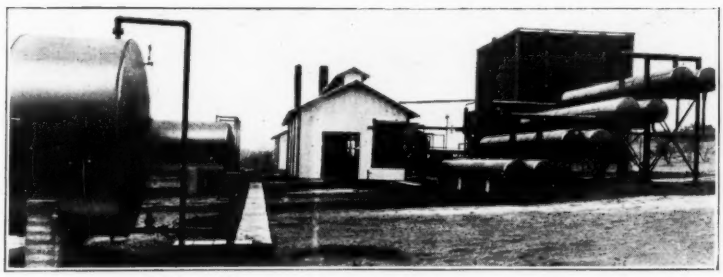

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M'f'rs. of Absorbers, Stills, Heat Exchangers and Condensing Equipment

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Consulting and Contracting Engineers in Natural Gas and Oil.

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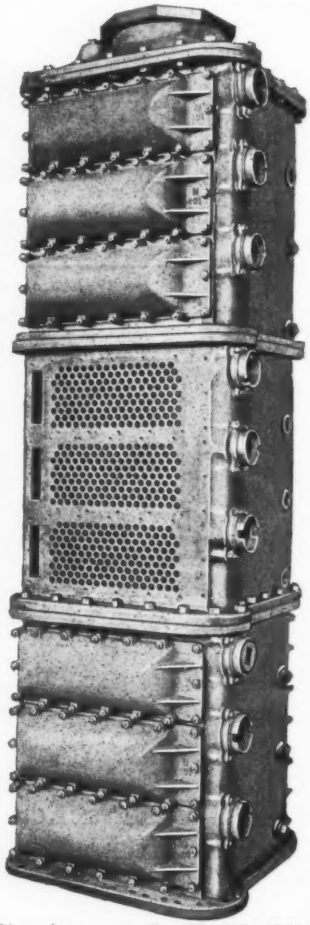
Pittsburgh, Penna.
Tulsa, Okla.
Casper, Wyo.

Materials Being Assembled For New Texas Refinery

Corsicana, Texas.—Materials are being assembled for the erection of a 1500 barrels daily capacity refinery to be located a short distance south of town on the H. & T. C. railroad at Angus station. The plant is being built by Edward E. Stewart, head of the Crystal Refining Company at Burkburnett, Texas; T. A. Edmonds of Fort Worth; and H. H. Cross and Company, marketers and jobbers of Chicago. It is planned to make use of a new type of cracking process in this plant, which will be connected to the newly discovered Corsicana-Powell field with a four inch pipe line, while crude will also be obtained from the Currie field in tank cars. A 40 car capacity loading rack is now being erected at the refinery site.

Type B-540 Gasoline Condenser
(Patented)

Compact — Efficient — Flexible



Dimensions — overall, 30" x 30" x 9'-0"
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SOUTHWESTERN CONDENSER COMPANY
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Grandfield Plant to Start Again After Long Shut Down

Grandfield, Okla.—After having been idle for the past 15 months, the 2,500-barrels-daily capacity skimming plant acquired early this year by the Twin Six Oil & Refining Company from the Union Oil & Refining Company resumed operations early in August. The plant is located at Grandfield and only a few miles north of the Burkburnett oil fields in Texas. It is operating on crude purchased on the "spot market."

Gasoline Plant to Handle Gas From New Oklahoma Pool

Tulsa, Okla.—With the recent completion of R. H. Smith's absorption gasoline plant in 32-8-8, Seminole County, that county makes its initial bow as the seat of natural gasoline manufacturing. This plant is at present without compressors, having a six-pound pressure, capable of consuming 2,000,000 cubic feet of gas from Smith's Foster 1, the discovery well of the new Seminole pool. It is intended in the near future to install two compressors increasing the pressure to 20 pounds, and the daily consumption capacity to 4,000,000 cubic feet. At the present time with a steady flow of gas the plant is capable of turning out about 4,000 gallons of gasoline daily. It is hardly likely, however, that such at total will be reached as the well from which the gas is obtained, flows by heads, and the result is that intermittently the plant has more gas than it can use and then less. Under prevailing conditions it will likely produce around 2,500 gallons daily.

The plant was designed by W. E. DeYarmett, of the Chieftain Gasoline Company, Tulsa, and W. L. Harris, also of Tulsa, built it.

El Dorado, Ark.—Two units of the Dubbs cracking process are to be installed by the Root Refineries, which is operating a 3000 barrel daily capacity plant near El Dorado.

Three Gasoline Plants Near Completion by Ohio Oil Co.

Haynesville, Louisiana.—The three natural gasoline manufacturing plants being erected by the Ohio Oil Company on its producing leases in the Haynesville field are to be in operation by the early part of September, and will represent an investment of approximately $75,000 each. The F. E. Hosmer special absorption system is to be used by each of the plants, which will be almost identical in construction, and will have a daily capacity of approximately 2,000,000 cubic feet of gas. Ingersoll-Rand vacuum pumps are to be used, and each plant will be operated with about 24 inch vacuum to 100 pounds pressure.

Expect to Have First Unit Ready for Operation Dec. 1

Arkansas City, Kans.—It is expected that a portion of the Roxana Petroleum Company's big refinery now under construction here will be ready for operation by December 1. Much of the preliminary work has been completed and the warehouse and machine shop and plant hospital already are finished. Foundations for the cracking stills are in and storage tanks are being erected.

The pipe line of the Ozark Pipe Line Company being laid from the Burbank and Tonkawa fields is about finished. This line is of eight inch pipe and will supply the Arkansas City plant with high gravity crude. As a protection against future flood damage the company is erecting at a cost of around $200,000 a dike system.

Okmulgee, Okla.—Charles Shaller, a workman, was killed and one other employe was injured by an explosion at the Empire Refineries plant here the first part of August which virtually destroyed five pressure stills and did other damage estimated at $150,000. The cause of the explosion which was immediately followed by fire has not been determined.

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The Vilter Manufacturing Co.

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Vilter Low Temperature Compression System (for efficiently producing low temperatures with compression system.)

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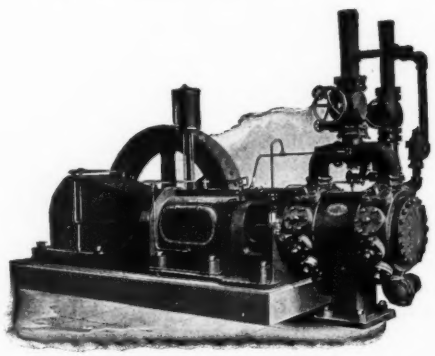

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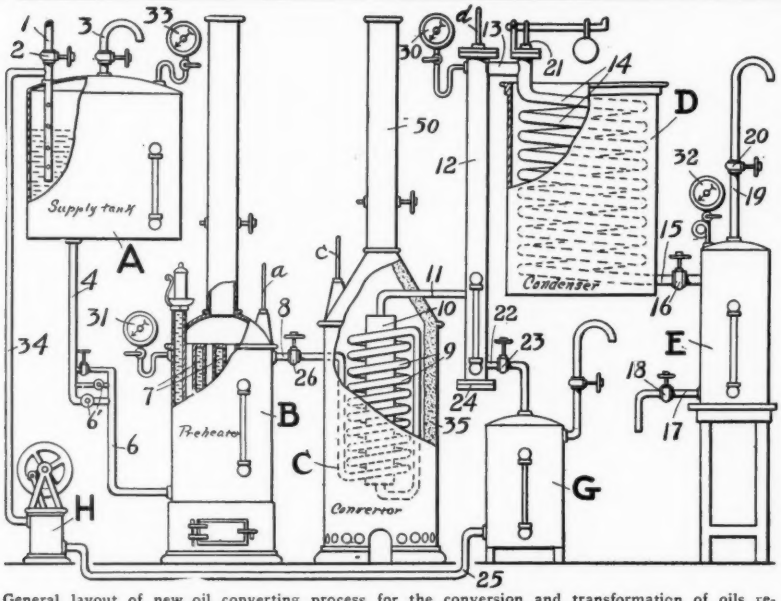
RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE



General layout of new oil converting process for the conversion and transformation of oils recently patented by J. H. Adams and consigned to The Texas Company.

Washington, D. C.—The following patents of interest to the oil-refining industry have recently been issued by the United States Patent Office at Washington

Conversion of Liquids

No. 1,461,017, a patent on an apparatus for the conversion and transformation of liquids, fluids and oils, issued on July 3 to Joseph H. Adams, assignor to The Texas Company, Houston, Texas, a corporation of Texas. This comprises, in an apparatus for converting high boiling hydrocarbon oil into lower boiling products, the combination of a converter, an outlet discharge pipe therefor located at a predetermined height immediate its ends, an inlet pipe communicating with said converter, means for continuously passing liquid oil through said inlet pipe into said converter and, in serving in conjunction with said outlet pipe to maintain a substantially constant oil level therein, a furnace surrounding said converter above its lower end for externally applying cracking heat under super-atmospheric seif-imposed vapor pressure to the oil therein, and means for returning to said converter for retreatment the liquid oil discharged therefrom.

Treating Hydrocarbons

No. 1,462,068, issued on July 17 to Levi H. Manning, of Tucson, Arizona, on a process of treating hydrocarbon oils. It comprises subjecting the oil to be treated to a continuous agitating movement within a normally stationary and closed chamber and to contact with freely movable metallic elements propelled within prescribed limits in said chamber, and subjecting said oil while in said chamber to a heat treatment applied to the exterior of the chamber.

The process of producing hydrocarbon oils having low boiling points from hydrocarbon oils having high boiling points which process comprises subjecting the oil to be treated to a pulsating agitating movement lengthwise within a closed tubular container, and subjecting said oil to a heat treatment of at least 700 degrees F. applied directly to the exterior of said container.

No. 1,462,069, issued on July 17 to Levi H. Manning, of Tucson, Arizona. In an apparatus for heat treating hydrocarbon oils, a cylindrical treatment chamber, means for heating the exterior of said chamber, a rotatable shaft extending centrally through the length of said chamber, and a series of vanes fixed on said shaft to rotate therewith, each vane having its broader face transverse to the axis of said shaft and being positioned at an inclined angle to the axis of said shaft.

No. 1,462,143, issued on July 17 to Frederick T. Manley, assignor to The Texas Company, New York, N. Y., a corporation of Texas. The continuous method of cracking hydrocarbon oils which comprises charging the oil into an elongated vertical still to maintain therein an extended column of liquid oil, maintaining said column of oil at a temperature and pressure sufficient for cracking, removing residue and vapors from the still to maintain a substantially constant liquid level therein, separating out the heavier constituents of said vapors and directly returning said constituents in cyclic passage through substantially the full length of the extended column of oil by positively forcing them into the bottom of the still.

No. 1,462,247, a patent on a treatment for hydrocarbons issued on July 17 to Walter F. Rittman, of Pittsburgh, Pa. It is a process for forming a low boiling hydrocarbon from a high boiling hydrocarbon which consists in cracking the high boiling hydrocarbon, segregating from the products of cracking the end product desired and then cracking the remaining hydrocarbons, one of the cracking operations consist-

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OIL PUMPS
For Hard Continuous Service

The pumps will not short stroke. Are substantially and carefully built. Have large and free passages which do not restrict the flow. Extremely economical in the use of steam.

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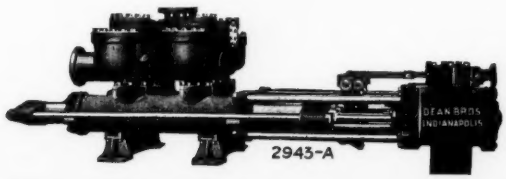

ing in subjecting the hydrocarbons in a relatively large liquid mass, to heat and pressure suitable for the production of the end product desired, segregating such end product, and the second operation consisting in vaporizing the material remaining after such segregating and subjecting such vapors to heat and pressure for a period of time suitable for the formation of the desired end product.

Treating Gasoline

No. 1,462,335, issued on an apparatus for treating gasoline to Thomas A. Gross, Frederick, Okla., on July 17. It is an apparatus for the treatment of gasoline and like liquids consisting of a plurality of units of which each consists of a cylindrical receptacle having a partition arranged therein and terminating short of the bottom and deflected laterally to provide a baffle, the partition dividing the receptacle into main and auxiliary compartments, a perforated coil adapted for connection to an air supply and disposed in the main compartment above said baffle, the receptacle being formed with a funnel shaped bottom by which communication between the two compartments is effected, a draw-off pipe at the apex of the funnel, an inlet disposed at the top of the main compartment, and an outlet means in the auxiliary compartment.

No. 1,462,677, issued on July 24 to Joseph H. Adams, assignor to The Texas Company, a corporation of Texas. It is for a process of converting high boiling hydrocarbon oil into lower boiling products in the vapor phase comprising heating the oil in a preheater under superatmospheric pressure to substantially its corresponding boiling point while maintaining the oil in liquid form, admitting the preheated liquid into a chamber under superatmospheric pressure somewhat less than the pressure under which the oil is preliminarily heated, where it breaks into vaporous form, and subjecting the vapors in the chamber to a cracking temperature to convert them to the vapor phase.

Converting Hydrocarbons

No. 1,462,678, issued on July 24 to Joseph H. Adams, assignor to The Texas Company, Houston, Texas, a corporation of Texas. This is also an apparatus for converting high boiling hydrocarbon oil into lower boiling products, comprising a furnace, a plurality of vertically disposed converter tubes located therein and heated to a cracking temperature under superatmospheric pressure and having their respective ends projecting through the upper and lower walls thereof, means for interconnecting the upper ends of said converter tubes above the heating zone, means for interconnecting the lower ends of the converter tubes below the heating zone, a supply tank outside said furnace, means for forcibly delivering oil from the supply tank to one of said interconnecting means whereby the oil is passed through said vertical converter tubes in flowing streams and cracked in transit, means for removing unconverted liquid oil from the other interconnecting means and returning it to the supply tank to be mixed with the oil therein and retreated, and means for removing the vapors evolved in transit through said converter tubes.

Devolatizing Coal

No. 1,460,41[illegible], issued on July 3 to Claude M. Garland, Chicago, Ill., on an apparatus for devolatizing coal, shale, etc. It comprises a heating chamber, a plurality of rows of vertical retorts extending through the said heating chamber, perforations in the side walls of the said retorts, an upper header communicating with the upper ends of a plurality of the retorts in a row, a gas outlet connection communicating with the said upper header, a sealed cover for closing the said upper header, a lower header communicating with the lower ends of the above said plurality of retorts, a swinging fuel support within the said lower header, a sealed cover for closing the bottom of the said lower header, a pipe for the discharge of superheated steam extending along each side of each row of retorts and near the bottom thereof, and a pipe for the removal of the said superheated steam and other products extending along each side of each row of retorts and near the top thereof, substantially as described.

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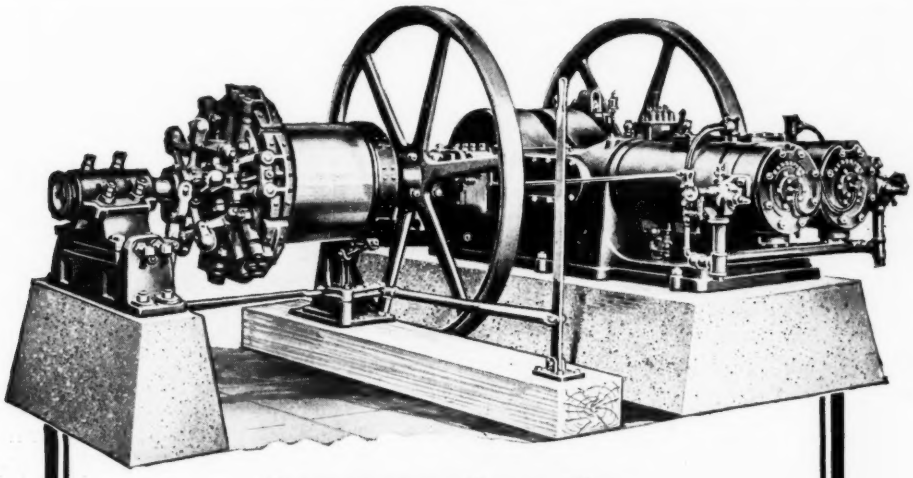
SOUTHWESTERN DISTRICT OFFICE
Petroleum Bldg., Tulsa

Inland Refining to Close Down Cushing, Okla., Plant

Cushing, Okla.—Local Officials of the Inland Refining Company have announced that the refinery operated here by that company will close at once. The unsettled condition of the refined market is given as the reason for closing. No statement has been issued as to when the plant will resume operations.



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The demand for a better drilling engine set Bessemer engineers to the task of designing and fabricating a 100% drilling unit, a unit to meet with universal favor. Many long months have been spent in perfecting and testing this unit to prove its worthiness of the Bessemer trade-mark. The results of the most gruelling tests have, however, conclusively proved the fact that Bessemer has again established a new leader in the Oil Industry.

The Bessemer 45 is a special twin cylinder 45 H. P. Bessemer Gas Engine with enclosed crank case, adjustable bearings, cross head construction, magneto ignition and with the Bessemer standard of quality built into every ounce.

The Drilling Clutch, an integral part of the unit, is a special Bessemer reversible type, which in combination with the power source, makes a most efficient and economical means of drilling deep oil wells.

The Bessemer 45 is easily transported; is speedy and reliable in action; and economical in upkeep. It is already popular with the drilling crews who have used it, and will soon be the favorite in all fields.

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÷ REFINERY SUPPLIES ÷

Unsettled Refined Situation Brings Lower Prices on Chemical Products

Chicago, Ill.—Price tendencies are downward in the chemical, miscellaneous oil and naval stores markets. Declines have been slight, however, during the past 30 days, with the exception of several fish oils which have shown pronounced declines. The exception to the general rule has been turpentine, which registered a slight advance during the month.

Among chemicals used by refiners three have weakened in price, others remaining firm. Potash permanganate is quoted at 16½ to 17½, a decline of a half cent. Revival of domestic manufacture plus heavy importations caused a condition of heavy supply, but lively buying has checked at present levels what it was thought might develop into a serious decline.

Nitrate of soda is quoted at $2.41 to $2.45. Importers failed to maintain the recent arbitrary advance in the face of a sluggish market. Potash bichromate has declined approximately three-quarters of a cent.

Menhaden and Herring oils have declined eight and five cents, respectively. Other animal, fish and vegetable oils are either firm or have shown declines of less than a cent.

Turpentine fluctuated in price somewhat, during the month. Its price tendency now appears downward though it is selling two cents higher than 30 days ago. All other naval stores are quoted lower than a month ago, including several which have been unchanged in price for many months. Tar is $1.50 to $2.50 lower in price, pitch 50 cents lower, and rosin oil a cent lower.

OIL JOBBERS SUPPLIES

Prices based on original packages in large quantities f. o. b. manufacturing point—unless otherwise specified.

Animal, Fish and Vegetable Oils

Lard Oils—	Price August 15
Prime, bbls., lb.	14¼
Extra Winter, Strained, bbls. lb.	12
Extra, bbls., lb.	11¼
Extra No. 1, bbls., lb.	10½
No. 1, bbls., lb.	10
No. 2, bbls., lb.	9½
Tallow, prime edible, lb.	7½
Tallow Oil, acidless, bbls., lb.	10¼
Lard Stearine, bbls., lb.	14½
Oleo Stearine, bbls., lb.	9¼
Neatsfoot Oil—	
Pure 20, cold test, bbls., lb.	15½
Pure 30, cold test, bbls., lb.	13¼
Extra, bbls. lb.	10½
No. 1, bbls., lb.	10
Horse Oil, bbls., lb.	7½
Red Oil, distilled, bbls., lb.	9½
English Degras, bbls., lb.	3¼ 4¼
Domestic Degras, bbls., lb.	4 4¼
Menhaden Fish Oil—	
Light Pressed, bbls., gal.	.65 .67
Yellow bleached, bbls., gal.	.68 .70
Herring Oil, tanks, coast, gal.	.35 .40
Whale Oil, bleached, bbls., gal.	.81 .83
Sperm Oil, bleached, bbls., gal.	.89 .94
Soya Bean Oil, pressed, bbls., lb	.12 12¼
Soya Bean Fatty Acids, tanks, West lb.	.12
Tallow Fatty Acids, bbls., lb.	.07 .07½
Castor Oil—	
No. 1, bbls., lb.	13½
No. 3, bbls., lb.	13

NAVAL STORES

(Quotations by National Rosin Oil & Size Company, Chicago.)

Rosins—		
B. to I. bbls. (280 lbs.)	$5.75	$5.95
10-20 bbl. lots, f. o. b. shipping point		7.05
K. to WW bbls., (280 lbs.)	5.95	7.25
10-20 bbl. lots, f. o. b. shipping point	6.85	8.75
Turpentine spirits ex yard gal.		.95
In drums		.93
Rosin Oil, first run, gal.		.45
Rosin Oil, second run, gal.		.47
Rosin Pitch, bbl.		5.50
Tar, kiln burned		11.00
Tar, retort		11.00

REFINERS' SUPPLIES

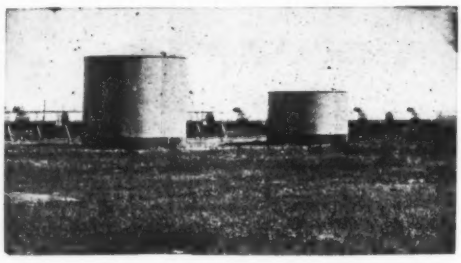
Prices are based on original packages, in large quantities, and represent spot quotations, unless otherwise stated, f. o. b. manufacturing points.

(Quotations by Wishnick-Trumpeer Chem. Co., Chicago.)

Soda Ash, light bags, cwt.	1.75	2.10
Silicate of Soda, 60 deg., tanks cwt.	1.60	...
Sal Soda, cwt.	1.15	1.25
Caustic Soda 76% drums cwt.	3.26	3.75
Chlorate of Soda, kegs, lb.	6½	7
Nitrate of Soda, cwt.	2.41	2.45
Potash Permanganate	.17	17½
Potash Bichromate, sacks, lb.	.10	10¼
Sulphuric Acid, 66 deg., tank cars ton	15	16
Acetic Acid—		
28% bbls., cwt.	3.38	3.63
56% bbls., cwt.	6.78	7.13
80% bbls., cwt.	11.41	11.60
Fullers Earth, 16-30 mesh, carloads, ton	$23.00	25.00
Chloride of Lime, cwt.	2.00	2.25
Benzol, pure, water white, gal.	.27	.32
Benzol, 90%, gal.	.25	.30
Toluol, gal.		30

Litharge

Chicago market, bbl. $10.40



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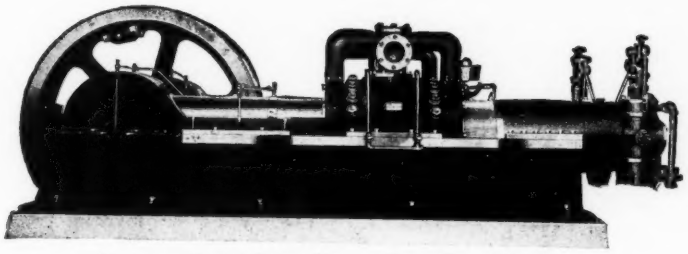

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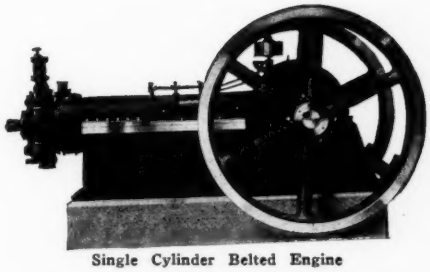
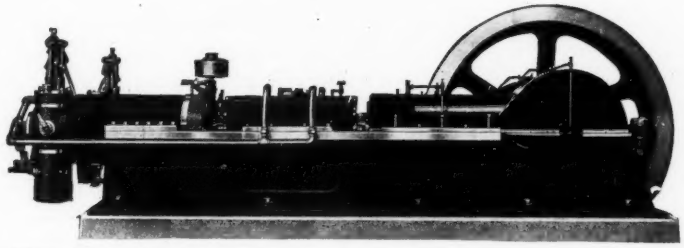
Pat. June 22, 1897; Oct. 6, 1914; April 13, 1915

High Efficiency Gas Engines, Compressors, and Vacuum Pumps for Power Plant Equipment

Sizes from 50 to 400 h. p.



Single Cylinder Belted Engine



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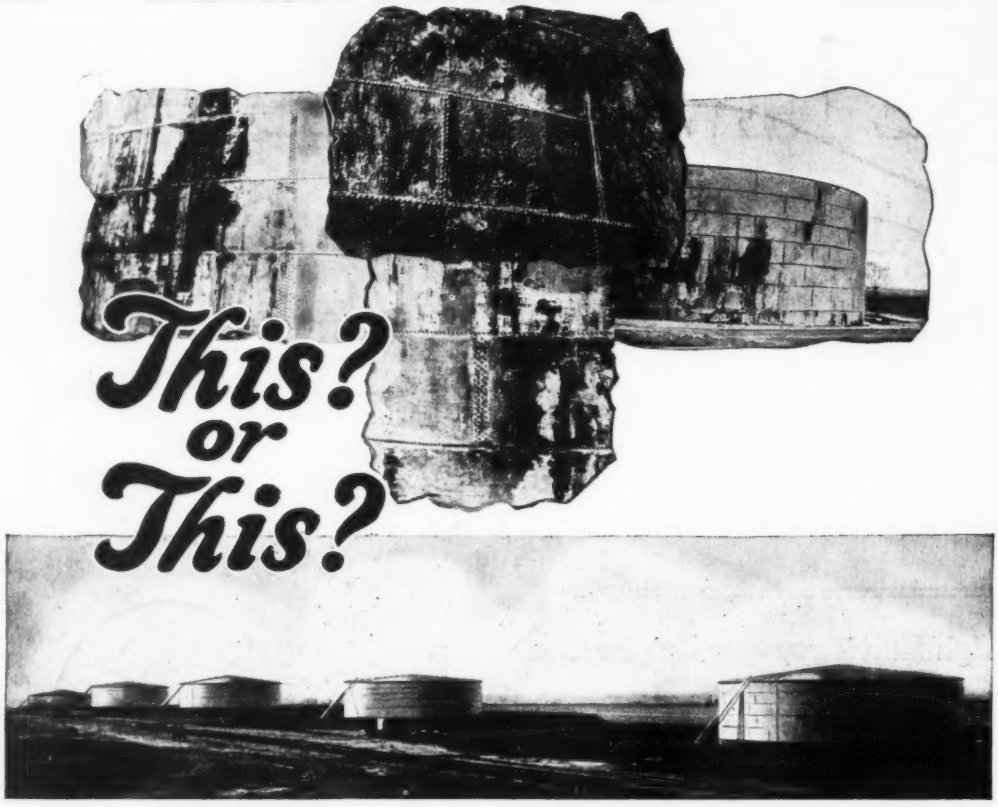

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